JOURNAL OF GAS LIGHTING & WATER SUPPLY.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CXXII., No. 2611.] TUESDAY, MAY 27, 1913. [65TH YEAR.

EDITORIAL NOTES.

Hygienic and Heating Efficiencies of Gas-Fires.

IT is hoped that our readers will not tire (from what we hear many will not) of the controversy that has broken out afresh regarding the hygienic and heating efficiencies of gas-fires, as, if fires can be constructed that will discharge the whole of their products of combustion in the proper, and not improper, direction without an accessory in the shape of a long draught-accelerating flue-pipe, and without loss, or without any considerable loss, of radiant efficiency, then such fires are surely things to be desired in the interests of the gas-supply industry. In our "Correspondence" columns to-day, Mr. H. James Yates complies with the request that we made in an editorial article on May 6, and subsequently by the Davis Gas-Stove Company in a letter, for results of the tests instituted by Professor Bone, and upon which results the opinion was based which was published in the issue of the "JOURNAL" already mentioned (p. 389). We should have been better pleased if Mr. Yates had left unsaid that Professor Bone agreed to the publication of the results as "a concession, and not as a matter of "right or necessity, because in his fiduciary position to us "as our consultant he is responsible only to us for the "reasons for his opinion, and not to any third party." That reads a little harsh; and it would have been equally as dignified, and certainly more agreeable, if Mr. Yates had stated that the figures were supplied as a matter of fairplay to trade competitors, in view of the published opinion of one in Professor Bone's position. However, the main thing is that figures, so far as they go, have now been published; and, in the interests of fairplay, we have no doubt that Messrs. John Wright and Co. will, if the request be made, willingly allow Mr. W. J. A. Butterfield, or any other recognized and responsible authority, acting on behalf of the Davis Gas-Stove Company, to both inspect the gas-fires with which experiment was made, and to learn more of the conditions under which the tests were carried out, in order that independent comparative scientific investigations may also be instituted on behalf of the Davis Company, and a reply be made of a character such as the technical men of the gas industry are entitled to.

Meantime, it does not appear to us that the Davis Gas-Stove Company need, nor will they, feel the slightest trepidation over the publication of either the statement of the conditions under which Professor Bone's tests were carried out, or the results obtained from those conditions, seeing that, as a matter of fact, the conditions do not comply with the cardinal and original point of this controversy. Bearing upon this, Mr. Yates, from the position in which he has installed himself in this matter, informs us that he cannot "acquiesce" in our attempt to enlarge the issues, so as to include any other question than the one under discussion. We were unaware that we had attempted to do anything of the kind. If we have, we bow to his decision not to "allow" us or his "other opponents" to confuse the original issue, or to run away from it. But we maintain that we have not done so. Our offence appears to be that we raised the question as to whether "the slight dropping of the canopy of a gas-fire in-"creases the ventilating effect more than a length of flue-"pipe attached at the back of the fire." If we are not dull-witted, that is a central point, and not a new issue, in the controversy. And so we rather think it is Mr. Yates, and not us, who has been confusing the issues, and attempting to run away from the point that originated this discussion, although we have never "acquiesced" in him doing so.

The original contention—we are sorry to have to emphasize it so often—was that a "fire that carries off its products "*without being attached to a flue*, will, when the *ordinary* "chimney draught [not *plus* a flue-pipe] comes into play, "inevitably carry off more than the products—to wit, an "unnecessary number of heat units as well, and a lowered "room-heating efficiency is the result." That is the original contention that was assailed in the editorial columns of the "JOURNAL;" and we should like Mr. Yates to get it, in all its import, thoroughly embedded in his mind. Now what do we find in the letter published to-day? That, in Professor Bone's tests, the Davis gas-fire had 3 ft. 10 in. of flue-pipe attached to it in two out of three of the experiments, in addition to the effect of the "ordinary chimney "draught"—only the height, and not the area, of which chimney is stated in the letter. Does Mr. Yates call this testing the point in dispute? If he does, we do not; if he does not, we agree with him. The proper trial would have been for the two fires to be tested with *ordinary* chimney draught, each fire having only just sufficient (if any) flue-pipe attached to prevent the products of combustion escaping under the canopy. That is the point that we have no doubt the independent expert appointed by the Davis Gas-Stove Company to carry out investigations will test, and publish the results without deeming it to be a concession to Messrs. John Wright and Co. or anyone else.

As already indicated, our anticipations are realized; the Davis gas-fire was in "B" and "C" tests dealt with in a manner which is not necessary under normal circumstances, and which abuses—by putting 3 ft. 10 in. of flue-pipe on the flue-vent, *plus* the ordinary chimney draught—the intention of the particular construction. Any really useful criticism of the figures cannot, under the circumstances, be made, until other figures are forthcoming as the result of independent tests made on behalf of the Davis firm. It may, however, be remarked that, in the "A" experiment, the two fires were tested without any flue attachment. The result was that, in the case of the Wright fire, the carbon dioxide in the flue products was less than in that of the Davis fire; the temperature of the flue products was also lower; the "relative radiant efficiency" was greater; and the "ap-"proximate" relative flue heat loss was less. This is most interesting, because, if the Wright fire requires a length of flue-pipe on it to obviate the escape of products of combustion from under the canopy, the figures are probably partly explained by the absence of the flue-pipe, and the emission of hot products into the room from the front of the fire, and not out of the flue-vent.

We now come to the figures for "B" test, in which the Davis fire was tried with a 3 ft. 10 in. length of flue-pipe attached, as in the case of the Wright fire, which length of flue-pipe presumably the Davis fire did not require, whatever may have been the necessity in the case of the Wright fire. The radiant efficiency figures, by the way, are not very expressive, nor do they convey any great meaning as they stand, for they are "expressed as a ratio of the "highest radiant efficiency observed" (whatever that may be as ordinarily expressed)—viz., in the case of the Wright fire "A" experiment. We are not prepared, however, to accept the Wright fire tested without a flue-pipe as the standard for anything, seeing that the firm would not construct a fire that sends the whole of its products through the flue-vent without being attached to a flue-pipe, as (to again quote Mr. Yates) "it would inevitably carry off more than the "products—to wit, an unnecessary number of heat units as "well, and a lowered room heating efficiency would result." The radiant efficiency in "A" test, judging from test "B," would probably have been 9 per cent. less for the fire, if a flue-pipe to the requisite extent had been attached. Bearing in mind that these are only relative figures taking the Wright fire test as the standard, we see that, when the unnecessary length of 3 ft. 10 in. of flue-pipe was attached to the Davis fire, the (comparing "B" with "A" test) relative radiant efficiency only dropped 0·03; in the case of the Wright fire, it dropped 0·08. Does this support Mr. Yates? The other figures, of course, can only be discussed after further trial. With regard to tests "C," the results were obtained under strong flue draught, intensified in the case of the Davis fire by the 3 ft. 10 in. of flue-pipe. It is a pity that this "strong flue draught" was due to "external weather and meteorological conditions," as the

conditions will be difficult to reproduce with certainty—in fact, if they were reproduced they might not be recognized, as there does not appear to be anything known of the conditions other than that an indefinite "strong" flue draught was created. There is another thing that we miss from the tests, and that is any results showing whether, under similar conditions, "the room heating efficiency" is less in one form of fire than the other. That was a point in Mr. Yates's original contention in the article of Sept. 3 last.

We have done our part in obtaining figures from Mr. Yates. It is now for others to deal with them in a more decisive way by the results of further independent tests. But meanwhile, we should like to say that Mr. Yates might give the "JOURNAL" credit for independence in this matter. If Wright had been Davis, and Davis had been Wright, we should have pursued precisely the same lines as we have done in this particular instance. Then, we venture to assert, Mr. Yates would not have suggested any break in the judicial attitude of the "JOURNAL" in controversy. However, all that is contained in the first four paragraphs of the letter is the personal view of Mr. Yates; and it weighs less with us—though we respect his opinions on many matters—than the several opinions that have been expressed, during the past two or three weeks, personally by gas engineers, who are pleased the "JOURNAL" has forced this question to the front—they preferring to forfeit, if necessary, a little radiant efficiency to secure the fullest possible assurance of hygienic efficiency. However, we will not raise a controversy on the judicial attitude of the "JOURNAL." Sufficient for the day is the question whether a fire that will carry off its products of combustion without a flue attached will carry off more heat units (and an unnecessary number) when the ordinary chimney draught comes into play, than a fire requiring, *plus* the ordinary chimney draught, a length of flue-pipe to prevent the products of combustion escaping under the canopy. The technical men of the gas industry will not regard Mr. Yates's letter as supplying full satisfaction on the point.

General Trading Points—Gas Undertakings and Benzol.

WE are living in moving times for the gas industry; but all do not seem to realize the full significance of current phases of the industry's affairs. We are not referring on this occasion to those questions associated with the technical work of manufacture which are with us now in new guise, and more than ever before. The matters that are in mind affect chiefly the trading of the industry in its own especial lines. When a backward glance is taken from the standpoint of present trading to (say) thirty years ago, how pronouncedly humdrum appears the commercial work of that time to the activity of the present, promoted and called for as it is by diverse factors in use and competition. In view of the vast change, it behoves gas managements to take stock occasionally to see that in every way the policy and operations of each undertaking are abreast of the present situation. Take cooking as an example. The gas-cooker is to-day the channel through which a very large consumption of gas proceeds. The enviable position of the gas-cooker is being assailed, and that vigorously, by electrical engineers. We know precisely what their claims are, and how far they materialize in practice. We know, too, how little they can hope to vie, economically and reliably, with the comprehensive service of the gas-cooker and its top-plate. Nevertheless, the electric-cooker will obtain to some extent a footing—just as the so-called electric-radiator has done. But what are gas undertakings doing to ensure that no part of their cooking business is taken from them under false pretences? Some are taking active steps; others are supine. Tales of noxious fumes, uneconomy, "meat" wastage, and the wrecking of the health of those who engage in gas cooking, are freely disseminated in some districts without being adequately met. The seed is being sown that will mean at last, despite the drawbacks of the expense and other limitations of the electric-cooker, the forfeiture of part of the gas-cooker business. In most cases, it will, with experience, be a very small part; in others, it will be greater. The degree of forfeiture, in any given area, will bear some relation to the degree of the activity of the electrical folk and the inactivity of the gas people. We know that in some areas the tales of disagreeable—we will not say noxious—odours from gas-cookers are warranted. The gas-cookers are put into houses, the householders are left to their own devices in connection with them, and there is no systematic overhauling and inspection. The negligent housewife and the indifferent servant allow the cooker to run along, getting into a foul state, until it seems almost past redemption, in the matter of the emission in use of objectionable smells, without a thorough overhaul. This condition is the electrical man's opportunity of vaunting the odourless character of the electric-oven, which, like the gas-oven, is only odourless so long as it is kept scrupulously clean. This is a matter of which gas managements in these times must not lose sight. No indirect concessions through neglect must be allowed the competitors.

Much the same remarks could be made regarding the lighting business; but gas undertakings generally are more alert in regard to the defence of their oldest line of business than many appear to be in connection with the newer ones. Possibly this is due to the fact that it is in the oldest line of business that competition has existed longest; but in this line, there are still gas managements that allow things to slide in lamentable fashion, and do not make the best use of the protective means at hand. We have said before, and are more confident of it than ever, that, had the gas industry early in the competition put forward the scientific advantages in regard to the quality and hygienic character of gas light, it would not have lost to the convenience of electric lighting in the matter of switching on and off (which convenience has since been largely countered by invention in regard to gas) so much of its lighting business as it did, though by new custom for lighting the loss has been more than compensated. There is again the gas-heating business, which, in the matter of efficiency, cannot be approached by the electrical competitor. But the fact must not be overlooked that—and it is quite natural—the purveyors of coal do not favourably regard the inroads the gas industry is making on their domestic trading field. A new competitor also threatens from the efforts that are being made to establish a low-temperature carbonization industry, with a view to meeting the demands for a home-produced motor spirit. This matter has to be looked at by the gas industry from a double point of view. A low-temperature carbonization industry cannot be commercially established if the smokeless fuel produced does not find a market; and those interested in a home-produced motor spirit will not leave any stone unturned to create the market, seeing that probably something like 55 to 60 per cent. of the receipts must come from the fuel in order to make the system pay, and enable the owners of the plants to sell their motor spirit at a competitive price with petrol, with, of course, the other products at the ruling market prices. If there is any systematized effort made to cultivate a smokeless fuel market, and there is success, so much the worse for the prosecution of the gas-fire business. This is a point that has to be considered by gas undertakings in deliberating upon the attitude they should take up in connection with benzol production.

Only the other day a prominent gas engineer, in conversation, remarked that he should not be at all adverse, at the works he controls, to washing the gas to recover the benzol if—indicating the Houses of Parliament—"they could be "convinced that the interests of the consumers would not "suffer." That is one trouble; and another is that the evidence is not yet entirely conclusive on the point as to the effect on the interests of consumers. But this is the only alternative—the washing of town gas—to the establishment of low-temperature carbonization systems for the sufficient home production of a motor spirit. Coke-oven owners are limited in what they can do by the demand for metallurgical coke. And so there are enterprising spirits who look upon gas undertakings as offering the line of least resistance to meeting motor requirements, and the members of the Houses of Parliament as being too sensible to offer any hostility to the motor car industry and motor car users being satisfied, with the suggested accruing monetary advantage to the gas industry and its consumers. We are afraid these enthusiasts do not know Parliament as the gas industry knows it. Assuming that Parliament could be persuaded to look generously upon the matter, Mr. W. J. A. Butterfield is the only expert who has yet offered suggestive points as to the effect for the consideration of the gas industry [*ante*, p. 517]. He calculates that the stripping of town gas of its benzol would give some 2 to 2½ gallons per 10,000 cubic feet per ton of coal carbonized. In the coke-oven industry about 3 gallons is calculated. The 2 to 2½ gallons would sell for from 2s. to 3s.; but *per contra* the gas would be reduced in thermal value by 6 to 7 per cent. It may be taken that

Mr. Butterfield arrives at the figure thus: Take ordinary low-grade gas as being of 540 B.Th.U. gross, which per 100 cubic feet would mean 54,000 B.Th.U. One cubic foot of benzene vapour (equal to about 2·8 gallons of liquid benzol per 10,000 cubic feet of gas) would represent 3740 B.Th.U. Deduct this from the 54,000 B.Th.U., and we have 99 cubic feet of stripped gas representing 50,260 B.Th.U., or 507 B.Th.U. per cubic foot. Thus there would be a loss of about 33 B.Th.U. per cubic foot, which would be compensated for per 1000 cubic feet by the money value of (say) 74 cubic feet of the reduced calorific power gas. This would be equal to rather more than 2d. worth of gas at 2s. 6d. per 1000 cubic feet. If, therefore, gas undertakings have to allow their consumers 2d. per 1000 cubic feet compensation, which would represent, on a production of 12,000 cubic feet of gas per ton, 2s., there does not appear to be much in the proposal from the gas undertaking's point of view, as it is not at all likely that the price of benzol in competition, and with wholesale production, would maintain its present market value. However, we are open to conviction to the contrary, on evidence being presented. There, however, we have a further trading point that the gas industry has to consider in these interesting times.

The question of domestic water-heating in bulk is one of great potentiality; and an article specially calling attention to this line of business appeared last week. It is a new business which holds out much promise, if gas undertakings will apply the same policy to it as was done in the case of gas-cookers. A few words as to power supply. This has met with strong competition from electricity, suction-gas plant, and the Diesel oil-engine. To-day, it is found that the managements of many electricity undertakings have discovered what was obvious to others before—that, save for specially good loads, the prices per unit they are charging are not remunerative; suction gas, through the troubles that follow from its use, is not now held in such high esteem as it was originally; and manufacturers using Diesel plant are now finding a disadvantage in the fluctuating prices of oil (particularly such prices as rule at present) and in the repair difficulties that arise. The experiences give opportunity to town gas; and it is for gas managements to put opportunity to good use. On the whole, the trading position it is seen calls for activity and alertness in many directions; and, with activity and alertness, the position is highly favourable.

Testimonials and Vacant Offices.

It has been represented to us that there ought to be, in fairness to candidates for advertised vacant positions, some revision in the condition that testimonials shall be forwarded in the first instance. The case for a change in practice is put somewhat in this form: In the present day, there is considerable competition for vacancies; and thus many candidates may go on year after year applying for positions unsuccessfully—not through any personal unfitness, but from the number of qualified men who apply. It becomes a grave hardship on these candidates to have to send a complete set of their testimonials time after time. They may ask for the return of the documents; but they know full well that to forward subsequently to advertisers copies of testimonials that present obvious signs of having passed through the post previously is not a personal recommendation. Testimonials, too, become somewhat out of date; and it is not an advantage to some of those seeking an improving appointment to be repeatedly asking their superiors for a fresh testimonial. There is another point, that many would-be candidates for positions—men of excellent qualifications—are deterred from applying for very fear that a request for a testimonial, and then failure to secure the appointment, might blight any prospects they have in the position they are at present occupying. This, of course, is not giving their present employers much credit for generosity. But still, in certain cases that have come to our knowledge, the fact that candidates have asked for a testimonial from their chiefs has resulted in the latter regarding them as unsettled in their present position; and this has been to their ultimate detriment in easily conceivable ways. Of course, the opposite is sometimes the case, where it is desired to retain the services of a good man. But the views of the engineers on this point do not always commend themselves to purse-tight administrators.

What has been suggested as a change is that candidates for vacant situations should not, in the first instance, be asked to send testimonials, but that their own letters, stating qualifications, experience, &c., should suffice for a selection to be made from the candidates. Supposing there were a hundred candidates for an office, and five were placed on the "short list," there would be some encouragement (and they would gladly respond) for the five to ask for up-to-date testimonials, and ninety-five would be saved the trouble of preparing copies or sending originals, or having to worry their chiefs for a currently dated testimonial. There is something in this representation, when looked at from the point of view of candidates; and we have sympathy with that point of view. On the other hand, from that of the advertisers, there would be an advantage—they would not have to wade through piles of testimonials, as they are in honour bound to do now, supplied by all the candidates, but only the testimonials of those placed on the "short list." It may be said that there is an advantage in having the testimonials in the first instance. But it is an advantage with attendant disadvantages on both sides. It would be quite easy for candidates to mention the names of those from whom their testimonials have been, and would be, obtained, together with the dates; and this would, for the time being, be sufficient guide to the advertiser. The matter is one that might be taken into consideration by advertisers, as we have often heard complaints of hardship arising from the necessity of providing testimonials upon first application.

Tarred Roads and Fish Destruction.

There was a mysterious occurrence in connection with the River Itchen in October, 1911. A large number of fish were destroyed; and the eyesight of the fish was affected. The Winchester Corporation had tarred their roads earlier in the year, the summer of which was very hot; and when a torrential rain came, the road washings and the contents of the storm-water drains were, after the long period of heat and calm, discharged into the river. The destruction of fish followed; but this may have been partly a coincidence. Since then, there has been much and frequent rain; but there has not been a recurrence of the trouble.

Those are the simple facts. The fishery interests attributed the destruction of the fish to the tar with which the roads had been treated; and the Winchester Corporation agreed not to again surface the roads with tar for three years. The northern division of the Hampshire Automobile Club instituted inquiries into the matter, being concerned in two ways—in the first place, by the prospect of having to revert to uncomfortable dusty roads; and, secondly, because the droppings of petrol and lubricating oil on the impervious tarred road, and their ultimate washing into the river, were also suspect. In instituting inquiries, they submitted the tar used, road washings, and the sample fish to experts for examination and report; and various facts were established, as will be seen by extracts from the report elsewhere. The greatest blot upon the inquiry is that the investigation did not take place till some four months after the destruction of the fish occurred. However, it was found, when the investigation was made, that the fish examined were not suffering from any disease; that the tar used was well up to the prescription of the Roads Board for tar to be employed in the neighbourhood of fisheries; that the tar contained no phenoloid bodies or ammonia in sufficient quantities to be poisonous to fish; and that there was nothing prejudicial to fish life in the washings taken in February. This seems to indicate that the tar *per se* could not have been the cause of the trouble, though it is quite possible the trouble might be an effect of the tarring. It must be remembered that the summer of 1911 was an exceptionally hot one; and that there was, for recent years, an abnormal period of drought. Though the report before us does not concede that this was the case (in fact, it does not positively determine anything as to the cause), we rather incline to the opinion that the hot summer, the absence of rain, and the impervious condition of the roads, combined to produce unusual surface conditions. This is indicated by the fact that, since the destruction of fish in October, 1911, although there have been frequent and heavy rainfalls, no further damage to the fish has occurred.

The facts are worth examining from this point of view. Through the impervious condition of the surface, and the absence of rain, there would be an accumulation of decomposing horse droppings; and the moisture would not be able to soak into the ground as formerly. Petrol and lubricating oils would also remain on the surface, and would be washed off direct from the surface into the drains by the occasional

road waterings. The electric light works on the bank of the river (at which point the trouble seems to have originated) might also have contributed to the lubricating oil entering the river; and there would also be the washings from garages and so forth. Ammonia has a greater toxic effect upon fish than phenoloid bodies; and, after a long period of drought followed by the heavy rain, it is quite possible that the horse manure washed from the roads might have a detrimental effect upon the fish in the stream into which the road washings were discharged. In a letter to the "Field," dealing with the subject of agricultural fertilizers, Mr. Butterfield mentions that he has found drainage from stable manure, equal to 0·2 part of ammonia in 1000 parts of water, will kill fish in 24 hours. Then, in regard to the petrol and lubricating oils, the report speaks of an iridescent film on the water, which indicated the presence of oil. This film would be quite sufficient to kill, and prevent the generation of, the food of the fish at the surface of the water. From the facts set forth, it would seem (although the problem must still be regarded as unsettled) that the impervious condition of the roads through tarring, the long drought, the heavy rains cleansing the road surfaces and the drains of matter detrimental to fish life, and the killing of the food of the fish by oil, were the contributory causes of the trouble in the River Itchen, and not directly the tar itself. But this is only a conclusion drawn from a consideration of the points presented in an indefinite report. The suggestion in the report that chemical changes may have occurred in the tar used—tar complying with the specification specially drafted to reduce to a negligible quantity the components of tar known to be dangerous to fish life—by exposure to the air and sun, has no present technical support.

However, though we regret the decision of the Winchester Corporation to abstain from tarring roads for the space of three years for the sake of peace, no real harm is done so far as the Winchester Gas and Water Company are concerned. If they do not sell the Corporation tar for road purposes, the latter must be larger customers for water for road-watering purposes. "What is lost on the swings is gained on the "roundabouts." Nevertheless, though this is the case so far as the Winchester Company are concerned, we should like to see this particular matter regarding the use of tar on roads near fisheries finally settled. The curious thing is that, though tarring is so universal now, since the long drought of 1911 no particularly noticeable trouble has occurred in fishery streams in any part of the country.

The Gas Coke Market.

WHILE the market reports speak of the sales of gas coke as being steady, intelligence reaches us of stocks beginning to accumulate in various quarters in uncomfortable proportions—proportions that have not been experienced now for some time past. For these undertakings, the current half year will not show so well as the immediately preceding ones in the matter of receipts for the first of the secondary products. The conditions that in the case of certain of these concerns have given rise to this position are twofold. It is the general experience that, when the price of coal is high, coke also finds a good market at higher prices. It has followed this course until comparatively recent times; but it is clear that where it matters little whether manufacturers use coal or coke, the coal contractors have created a position which is unusual when the price of gas coal is heavy. While gas coal has been put up to a high and unreasonable figure, other industries have been offered, and have bought, coal at a price to compete with which coke would have to be offered at a much cut figure. To largely reduce the price of coke in one direction would mean the pulling-down of the price all round; the only alternative being the accumulation of stocks. But if the increase in the price of coal to manufacturers continues lower than to gas coal users, and stocks of coke are further augmented, then there will be no option but to make the price of the latter create a better market by seriously entering into competition with coal that is being sold at a level which does not include such a large increase as in the case of gas coal. The gas industry, however, has no desire to see other manufacturers saddled with higher costs for solid fuel. The trouble is that the gas industry's own raw material has had such a heavy burden imposed upon it by the colliery owners, who are now trying to get still more, while the chances of gas undertakings partly recovering the increase through their sales of coke are steadily diminishing. It is a matter for serious protest. But if coke stocks continue to increase, there can be only one end to the position; as a matter of fact, some undertakings are already marketing their coke at lower prices than have ruled at any time during the past few half years. Another cause—a smaller one—operating towards accumulation of stocks is that the price of oil is anything but favourable to several gas-works being themselves customers for their own coke through their water-gas plants. We know of various works that have, owing to oil market conditions, shut-down their water-gas plant, or have largely reduced production. The situation for some concerns is therefore not a pleasant one, in view of the position of contract prices for gas coals, and the unreasonable attitude of the coal owners.

Our German Contemporary and the Woodall-Duckham System.

In the "JOURNAL" for May 13, we dealt with an unwarranted attack on the Woodall-Duckham system of continuous carbonization that had appeared in the "Journal für Gasbeleuchtung." As to the authorship of the article in question, we have not the remotest knowledge. We felt sure, however, that those who have been prominently identified with the technical development and commercial working of the Dessau system in Germany possessed higher ideals than to sink to the level of traducing, through the columns of a technical paper, and in the manner criticized by us, a rival carbonizing system. Upon inquiry, we have received the best of assurance, and, in fact, are authorized to state, that no one identified with the Imperial Continental Gas Association, nor Dr. Bueb, nor anyone else interested in the Dessauer Vertical-Ofen Gesellschaft, had anything to do with the publication of the article in our German contemporary, nor have they the slightest notion who was the author. We are glad, indeed, to be able to dissociate in this general statement so many of our friends in Germany from this (as we have already described it) "unwarranted attack" upon one of the continuous vertical systems, which attack, as has been shown, included statements and innuendo that were positively untrue.

Gas-Works Results at Birmingham

The slightly smaller proportions on the present occasion, as compared with a year ago, of the handsome surplus to be paid over by the Birmingham Gas Department were amply explained at the Council meeting last week, when it was pointed out that the assessments of the works and mains had been so increased that for the second half of the year £4500 more was paid in rates than would have been the case under the old assessments; while increases in workmen's wages represent something like £10,000 a year. And there was the coal strike, too, and also the full effect of a reduction in price—equal to giving the consumers a sum of £70,000. Yet the net cash balance of profit, at £77,725, was only £2956 less than that for the preceding year. The explanation of this prosperous condition of affairs, of course, is an increase of 8½ per cent. in the consumption of gas—an excellent achievement, when it is remembered that the increase is calculated on a figure of upwards of 8000 million cubic feet. The Birmingham Gas Department has earned the gratitude of the ratepayers; but the gas consumers have at the same time had a share of the good things going. In the last three years, it was pointed out, the department has paid in cash to the rates £243,610; prices to consumers have been reduced to an extent equal to 16 per cent. (say, £130,000); there has been an allowance on behalf of public lighting of about £33,000; and the outstanding debt has been reduced by more than £122,000. If large sums must be handed over by gas undertakings in aid of the rates, the policy is certainly more likely to commend itself to consumers of gas when it is accompanied by substantial concessions in price. The progress of the Birmingham Gas Department shows that all connected with it have set themselves a high standard to "live up to."

And Some Other Places.

Glancing through the numerous other reports to hand of the financial results of gas undertakings in the hands of local authorities, it may be mentioned that at Ashton-in-Makerfield there is some increase in the net profit, and that the prudent course of forming a reserve fund is to be adopted. A sum of £2000 has been transferred to the district fund from the gas profits at Brighouse. The net profit at Burton-upon-Trent, at £13,500, is about

£1000 down; but an amount of £5000 has been spent in the provision of meters and stoves. The rates are to receive £7000; and the balance goes to the reserve fund. At Coventry, the rates are to benefit to the extent of £5000, while £10,000 is to be set aside towards meeting the loss of capital consequent on the abandonment of plant at the old works. Regarding the new installation of vertical retorts at Heywood, on the Glover-West principle, it is remarked that the plant has only been in operation a short time, but there is every indication the expenditure on it will be justified. Though the net profit is somewhat reduced, this is really due to the enhanced cost of coal, and not to any falling off in the total gas consumption, the figures of which exhibit an increase. There has been contributed to the borough fund in aid of the rates at Lancaster the sum of £6000, while £2300 has been carried to the reserve fund. Coming to Maryport, the profit is nearly £900 up, at £1300. In view of considerable expenditure on regenerative retorts (which are to be paid for out of two years' revenue), £1100 has been transferred to the reserve. The St. Helens Gas Committee recommend that a sum of £5000 out of the profits for the past year should be devoted to the relief of the rates. With an increased output of over 5½ per cent., there is an available balance of nearly £6500 at Stafford. This is a falling off of £2500; but there has been a reduction in price, and heavy expenditure on repairs, &c. The Committee recommend a total contribution of £3850 to the district fund.

Gas Coal Prices.

The Daily Press appears to be waking up to the fact that the colliery owners are pressing industry unduly in connection with coal prices. Some new gas coal contracts have been settled at a further advance of 1s. 6d. and 2s. per ton; and last Saturday the "Standard" in an article on "Colliery Contracts and Coal Mining Profits," stated that in the Midlands there has already been an increase of from 1s. 3d. to 1s. 6d. per ton in gas coal prices. There is no doubt about it, we are in for another year of high-priced coal; and our contemporary questions whether these high prices are justified. The gas industry settled that question a year or more ago. It is, however, the opinion of the "Standard" that the present high prices of coal are due to something approaching a ring among the colliery proprietors. Correspondence in our columns of a time ago, or rather the part of it representing the views of the colliery owners, repudiated anything of the kind, except in so far as agreements concerning increases are concerned. Our contemporary is, therefore, fully justified in saying that if that is not a ring, there is no doubt the coal-mining interests understand one another thoroughly, and to such an extent that there seems to be but little real competition. However, agitation among the largest consumers is growing; and public opinion on the matter, our contemporary thinks, may make itself felt hereafter. We have heard an abundance of oral protest in connection with the matter; but we should now like to witness a little more concerted action. Why should not the gas, electric, railway, water, and other statutory interests combine to set the ball rolling to a no uncertain national protest, and make the Government hear and, hearing, heed the voice of the large industries? Why the industrial interests of the whole country should be held at the mercy of a small section of coalowners and shareholders, without control, passes comprehension.

We learn that Mr. Samuel S. Mellor has relinquished, on account of ill-health, the position of Engineer, Manager, and Secretary of the Northwich Gas Company. Mr. Mellor, it may be remembered, was for many years Hon. Secretary of the Manchester District Institution of Gas Engineers, which he joined in 1885.

The members of the Manchester District Institution of Gas Engineers will hold their 167th quarterly meeting on Saturday at Chester, the home of the President, Mr. John C. Belton. The programme which has been issued by the Hon. Secretary (Mr. W. Whatmough, of Heywood) includes an inspection of the gas-works, at the close of which the members will be entertained at luncheon by the Chairman and Directors of the Chester United Gas Company. The only business will be the confirmation of the minutes of the previous meeting and the introduction of three new members—viz., Mr. C. Loveridge, of Chesterton, Mr. J. H. Davies, of Oswaldtwistle, and Mr. W. L. Heald, of Preston. In the afternoon, there will be an excursion up the Dee, and, by permission of his Grace the Duke of Westminster, the party will visit Eaton Hall and grounds. Before returning to Chester, they will be invited by the President and Mrs. Belton to partake of tea.

ELECTRICITY SUPPLY MEMORANDA.

THE electricity supply industry is in a bit of a quandary over the prices charged for energy for power purposes. At one time, when there was the slightest suggestion that in some cases consumers were being charged for power at below a paying rate, and that the lighting consumers had to bear the brunt of the deficiency, there was always the supercilious reply that the critic did not know what he was talking about. It seems now that the gentlemen making supercilious reply did not know, or did not choose to profess that they knew, what they were talking about. With the increase in the power output in some places, and the practically motionless lighting load, the advance in capital and general standing charges is forcing itself unpleasantly to the front. These charges refuse to be longer regarded as something intangible in respect of the power load. Electricity undertakings, like other industrial concerns, also feel the growing cost of living; and this further helps to show-up the folly of close-shaven charges for power, without any proper consideration for standing charges. There are some undertakings, as we have pointed out before, that have raised the prices of energy for power purposes, realizing that it is preferable to place the tariff on a better footing than let things slide along as they are now doing. On the other hand, there are managements of undertakings with considerable consumers of energy connected to the cables who are absolutely afraid to suggest increasing the price, as they are well aware that manufacturers with private gas-driven generating sets, can produce current for themselves, for both lighting and power, at prices with which the electricity undertaking cannot profitably compete. Many are the electrical engineers who are to-day perfectly conscious that some of their power tariffs are on an unsound basis, but yet they cannot bring themselves to acknowledge the fact out of sheer fright over what might happen if they once acknowledged that, on any one contract, they were playing a losing game. Official dignity is also at stake because the non-paying contracts must have been originally entered into on official recommendation. Those officials who are in this position are bidden to be of good cheer, in view of what West Ham, Newcastle, and other large industrial centres have done on low power charges. The omission is consistently made of not pointing out that some time since there was a little rising of power prices at West Ham, and there is also oversight in not mentioning that such industrially thriving localities are unrepresentative of the general run of towns where low power prices are found to exist.

Low Power Prices.

The matter of power prices was recently revived through a paper by Mr. Sidney Simpson before the Yorkshire Section of the Institution of Electrical Engineers. While some of those members who discussed the communication were not prepared to pronouncedly agree with Mr. Simpson that undercharging for power purposes was generally going on, the criticisms of his paper were of such a feeble character that the author, though certain of his figures erred a little on the side that emphasized his contentions, may be said to have made out a good case. There were also speakers who were inclined to justify uncommercial charges on the ground of expediency, which is an indirect compliment both to the gas-engine and to private generating plants. Mr. Simpson in his paper gave a number of instances showing that, when standing charges per unit sold covering repayment of capital in fifteen years at 3½ per cent. interest, works costs, and other net costs per unit sold, were added together, and placed in comparison with the average price received, there was a serious loss between present conditions and those that should actually obtain to make things financially secure. The average of fifteen years was perhaps the weakest spot in the paper, in view of the fact that while generating machinery should not be allowed more than this time, and meters, motors, and other things, much less, site, buildings, and cables are entitled to a longer period. Still, Mr. Simpson's fifteen years' average was not a great way out; and raising the average he could still make good his case—showing that something was wrong when average receipts exhibit a result below the average, and correctly chargeable, outgoings. However, Mr. Simpson is not prepared to admit, after instituting a survey of the past fifteen years, that more than fifteen years' depreciation should be allowed. This, however, seems to be the only solid criticism of the paper that was made in the discussion; and there was a fair amount of agreement that in many instances power users had been treated too liberally, and at the expense of the lighting consumers. There is anxiety, however, over the private generating plant. Mr. T. Roles, of Bradford, held that what central station engineers should do is to try to supply at a price at which an individual manufacturer can produce for himself; and he mentioned that manufacturers can supply their own power at ⅜d. or (say) 0·4d. per unit. Prices for commodities are largely ruled (where rings or sliding-scales of dividend and price do not exist) by competition; and while it is right enough to aim at the competitive price, the central station engineer should be reasonable, and see that he is not injuring any other of his patrons by the price fixed for a power contract. The "Electrician" defends the low power price. It says: "It may be necessary to work for a time at unremunerative rates, and thus to provide for the future; but there is nothing uncommercial in this,

Criticism and Defence.

if it *seems likely* to lead to a successful issue." There is good all-round speculation embedded in the second part of this quotation; and whether where there is much speculation, there is nothing uncommercial, is a matter upon which we need not pronounce any opinion. Our contemporary proceeds: "Every power company, for example, has found it necessary to work on these lines to start with; otherwise, no business could be done. As the amount of energy sold increases, the cost of giving a supply diminishes, until finally the financial result becomes satisfactory." The "Electrician" tables show several electric power companies. But from them we cannot gather the information as to whether they are all paying dividends on the whole of their capitals. If not, why not in 1913?

Gas and Diesel Engines.

There recently appeared in the "Electrical Review" an extremely interesting article by Mr. A. N. Rye, giving experiences with pressure gas-producers and engines and Diesel oil-engines in generating electricity at the St. Sampson's and Les Amballes stations of the Guernsey Electric Light and Power Company. At the former station, there were both pressure gas-producers and engines and Diesel engines, and at the latter Diesel engines only. Mr. Rye supplies full particulars as to the fuel costs for the three plants in 1912; and it will be of interest to amalgamate certain columns from the tables:

Month.	St. Sampson's Gas-Engines.			St. Sampson's Oil-Engines.			Oil-Engines, Les Amballes.		
	Lbs. per Unit.	Cost per Ton.	Per Unit.	Lb. per Unit.	Cost per Ton.	Per Unit.	Lb. per Unit.	Cost per Ton.	Per Unit.
Jan.	3·2	17/10	·31d.	·75	51/-	·20d.	·675	54/-	·19d.
Feb.	3·0	,,	·29d.	·8	56/6	·23d.	·645	59/6	·20d.
March	3·2	,,	·31d.	·70	,,	·21d.	·677	,,	·21d.
April	2·14	,,	·21d.	·687	,,	·21d.	·672	,,	·21d.
May	1·93	,,	·18d.	·677	,,	·21d.	·673	,,	·21d.
June	2·14	18/6	·21d.	·675	,,	·20d.	·657	,,	·21d.
July	2·2	19/-	·22d.	·651	,,	·20d.	·629	,,	·20d.
August	2·33	18/-	·22d.	·67	,,	·20d.	·67	,,	·21d.
Sept.	2·06	19/6	·21d.	·684	,,	·20d.	·66	,,	·21d.
October	2·0	,,	·21d.	·701	65/6	·25d.	·678	68/6	·25d.
Nov.	1·9	,,	·20d.	·7	,,	·25d.	·688	,,	·25d.
Dec.	2·0	,,	·21d.	·738	,,	·26d.	·69	,,	·25d.
Total	2·25		·225d.	·696		·213d.	·670		·221d.

The total number of units generated during 1912 by the St. Sampson's gas-engine plant was 844,876; by the oil-engines at the same station, 447,685; and by the oil-engines at Les Amballes, 572,675. In the case of the gas-engines, two of them were eight years old; and in 1911 it was decided to thoroughly overhaul them—the work not being completed until July of last year. The oil-engines were comparatively new. In consequence of this, Mr. Rye suggests that the figures for the first three months of the year in the case of the gas-engines should be discarded. If this is done, notwithstanding that the price of coal rose, the average cost for fuel per unit for the nine months was only 0·208d. The great variations in the cost of oil will be noted; and towards the end of the year, the gas-engines were decidedly cheaper than the oil-engines in fuel costs. Since then, through still higher prices for oil, this difference has become so much accentuated that the Diesel engines are being run as little as possible. At present prices, the author tells us, the costs of running the Diesel engines are so heavy that it is fairly certain that no more engines of this type will be installed until oil prices fall. In that event, it seems to us, experience shows there would be very considerable danger. The author then proceeds to show that, with internal combustion engines on a public supply plant, there are costs that are inseparable from them; but we would emphasize the point that, in the case of the gas-engines, he is referring to producer gas, and not to the clean and regular town gas supply. This makes a considerable difference in the matter of the reliable running of an engine. However, with the plants—both gas and oil—with which Mr. Rye is dealing, a large battery is needed to ensure continuity of supply. The defects are not, as a rule, serious, but merely trifling. He experiences more small troubles with the engines running on producer gas than with engines running on oil; but, on the other hand, the Diesel engines give less warning of failure and usually take longer to put right. He also recommends having plenty of spare plant, particularly with the Diesel engine, owing to the considerable degree of accuracy essential when making adjustments and repairs. However, while the severe fluctuations to which the oil market is subject will restrict the use of the Diesel engine, Mr. Rye considers that, under normal conditions, the installation of both forms of engine has been justified; the saving in the fuel bill having been more than sufficient to balance increased costs in other directions.

Fatalities.

The roll of electrical fatalities in industrial establishments continues to extend. Several fresh cases have been reported since last reference was made in the "Memoranda" to the frequent unhappy occurrences; and the channels of electrical information have recognized the seriousness for the reputation of electricity of these repeated happenings. Regulations there are by the hundred; but, despite these, there is evidence that every small detail of an installation requires frequent supervision, and every assurance requires to be made that only competent persons are employed on the electrical work. The "Electrical Review" has particularly of late devoted itself to giving expression to its views that only competent persons should be employed, and that proper training for all engaged on electrical work should be provided, in order that "competent persons" only are brought into this dangerous occupation. Accidents, of course, will happen in connection with the best of regulated electrical systems; but in many of the accidents that have taken place, it has been seen how easy it is for a detail to fall unnoticed into death-yielding order, and how short, in connection with that disordered detail, is the step from life to death. The "Electrical Times" lately, in a paragraph referring to a case in which crass ignorance was shown in respect of a point as to voltage, remarked, "What a field there is for a battalion of inspectors to go up and down the country to look after details, and what a need for the sound education in electrical principles of those who are in any way connected with electricity." This remark was made in association with the death of a boy aged only 14 years, who met his end by touching the metal guard of a lamp which had become charged simply owing to the sharp corner of the fitting cutting through the installation, and making metallic contact with a live wire. The voltage was 440; and four lamps in series were connected to the wire. One of the colliery "electricians" considered that the voltage was therefore only 110, instead of 440; and this is one of the instances of ignorance that gave rise to the comments of the electrical contemporaries named. In the case of a switch attendant at the New London Colliery, Eastwood, who was killed through falling across a live wire (450 volts), while switching-off the current supplying a conveyor, the jury at the inquest considered that better protection should be afforded—notwithstanding regulations, inspectors, and what not. At the Houghton Main Colliery, a man working a coal-cutter (electrically operated) was recently killed. At the Helsby Cable Works, a man was killed while testing cables, having omitted to earth the cable. There are other reported fatalities close to date; but these samples are enough.

Half-Frosted Lamps.

An interesting contribution has appeared in the "Electrician," by Messrs. A. J. Makower, M.A., and U. A. Oschwald, B.A., on the subject of half-frosted incandescent lamps. The available data on the point being of a negligible quantity, the authors carried out investigations to put themselves in possession of information in regard to it. The horizontal candle power for each lamp tested with the bulb unfrosted was called 100 units. Testing metallic filament lamps, one finding is that the candle power is reduced by frosting from 100 to 90·8 units in the horizontal direction, and increased by 20·5 to 34 units in the vertical direction. A calculation from a number of values given in the article shows for the mean hemispherical candle power with clear bulb 77·5 units, and with half-frosted bulb 67·9 units. Generally, the reduction by frosting of the mean hemispherical candle powers varies between 10 and 20 per cent.; the variation being mainly due to the thickness of the frosting. The curves for the distribution of the light of each lamp, with and without frosting, intersect at an angle very close to 66°; and the candle power at this angle is, in each case, very nearly 45 per cent. of the horizontal candle power of the clear lamp. Thus the horizontal candle power of the clear bulb may be found by multiplying by 2·22 that obtained with the half-frosted bulb at 66°. These figures may be useful to other investigators.

Safety.

Occasionally our electrical contemporaries appear to be sadly lacking in information regarding the commodity which they specially advocate. An article has appeared in the "Electrical Times" describing the lighting and heating by electrical means of St. Cuthbert's Church, York. In the course of the article are these words: "The absence of trouble, dirt, and smell, to say nothing of the increased safety, and the ease with which the temperature can be controlled, are considerations which cannot be ignored by those responsible for the upkeep of public buildings." As to the "trouble" and "safety," a few incidents may relieve our contemporary of the danger of repeating its error. Without going further back than last year, there were the fires that occurred at Christ Church, Salford, and St. Mark's Church, Newport (Mon.); and the failures that occurred at the Congregational Church, Ilkeston, at St. Saviour's, Guildford, and at Christ Church, Croydon—the last-named during a confirmation service. These are only examples; but they will suffice to show that the "Electrical Times" ought not to speak of "absence of trouble" and "increased safety" due to the use of electricity in places where people are taught to have respect for the truth.

Electricity Generating-Stations to Go.

Nitrogen is extracted from the air for the production of artificial fertilizers, oxygen is also extracted and bottled-up, those wicked gas burners, fires, and cooking-stoves also (speaking electrically) "exhaust" the air of oxygen, coal grates and central electricity station steam-producing plant also use up an abominable amount of oxygen, and now there is a "remarkable invention" being written about which is going to collect electricity from the air,

and revolutionize the world's affairs, and incidentally scrap central electricity generating stations as at present existing, and place on the same heap for rust to corrupt those magnificent gas-works that are the centres of the wealth production of the gas industry. Some information about the marvellous new invention has just been imparted, through the "Manchester Evening News," to the citizens by Mr. J. W. Cook, who is a member of the civic governing body, and a manufacturer of textile specialities. During a run in the States, this gentleman came across the invention, and was so struck with its possibilities that he acquired the manufacturing rights for Great Britain, France, India, Russia, and a few other countries. As described by our evening contemporary, the electrical collector is built up of absorbers or accumulators (composed of zinc plates and magnetized steel, or peculiarly treated magnetized steel only); compound-rectifying-exciter-transformers; automatic governor, circuit-breaker, or lightning arrester; and a tower. This description of the wonderful structure it will be admitted is very explicit, but it will supplement interest if it is mentioned that the function of the compound-rectifying-exciter-transformer is to prepare the ambient elemental electric forces, after being gathered by the accumulators for use. By its means, the voltage and amperage can be altered as desired. The machine produces a continuous direct current—so it is said. "An inventor without imagination would be as impossible as a poet without ideas." That is beautifully put. The idea of this particular inventor is that his machine is going to be a fabulous boon and blessing to mankind—supplying the world with light, heat, and power at an absurdly small cost. We do not know what Mr. Cook paid for the manufacturing rights for this and other countries; but we shall be most happy to learn of the progress of his fortune-building from this revolutionizing, but, to our poor comprehension, somewhat vague, project of the American inventor.

OBITUARY.

ARTHUR GRAHAM.

Last Saturday, intelligence reached Nottinghamshire, and occasioned great regret, which will be felt in a wider area where he was known, of the sudden death, at Bruges, of Mr. Arthur Graham, the Gas and Water Engineer to the Corporation of Mansfield. Deceased had been connected officially for twenty years with the North Nottinghamshire town—occupying his position during a period of its greatest development. Although not in the best of health, Mr. Graham had until quite recently been attending to his duties as usual; being present on the 16th inst. at a meeting of the Council, when, among other matters, the suggested reduction of rates to slot-meter gas consumers, to which reference was made in the "Journal" last week (p. 543), was debated. He left the following day for a Continental trip, visiting Brussels, and subsequently journeying to Bruges. From the old-world belfry town a telegraphic communication was received at Mansfield on Friday evening by members of the family—a friend with whom Mr. Graham had been travelling intimating sudden illness, and asking that somebody might go over at once. But before the journey could be accomplished the sorrowful information was forwarded that death had supervened; this having occurred at six o'clock on Saturday morning.

Mr. Graham's work at Mansfield was of an invaluable character. He held office during a time when the gas-works were remodelled and the water-works underwent important extensions. Revenue-earning powers of the undertakings, under his discriminating control, were illustrated by substantial allocation of profits in relief of the rates. He joined the Gas Institute in 1894, and served upon the Council; and he passed into the present Institution. He was much earlier associated with the Manchester District Institution of Gas Engineers—having entered in 1887, when he was at Lymm. He served on the Committee, and was President in 1902, in succession to Mr. Charles Wood.

Apart from his professional work, Mr. Graham was held in the highest esteem in Mansfield. He had displayed active interest in the town's chief athletic organizations, represented by the Football and Cricket Clubs, being Vice-President of each; while he had also officiated as President of the Bowling Club. Members of the Masonic body will especially mourn his unexpected demise. Ten years ago he filled the chair of the Forest Lodge, which occupies a high place in the Province of which the Duke of Portland is the head; and he had held office also in the Notts Provincial Grand Lodge, the nature of whose charitable work is marked by an ever-broadening tendency.

New Bland Pendants.—Attention is called by the Bland Light Syndicate, Limited, of No. 29, Little Trinity Lane, E.C., to some new two-light inverted burner pendants which have been designed by Mr. Gould. These "Unique" fittings can be had in several finishes, and are decidedly attractive in appearance. Though no great originality in design is claimed for them, they constitute a departure from the ordinary lines that are associated with the gas-pendant, with its single down-rod and body. They should prove a welcome addition in the show-rooms of gas undertakings, where visitors are ever on the look-out for some new designs of fittings.

GERMAN ASSOCIATION OF GAS AND WATER ENGINEERS.

Programme of Annual General Meeting.

The Fifty-Fourth Annual General Meeting of this Association will be held, as already announced, from Monday, June 23, to Friday, June 27 next, at Strasburg, under the chairmanship of Herr F. Reese, the Manager of the Dortmund Water-Works, who is President of the Association. The programme of arrangements for the meeting has now been issued.

The customary reception and assembly will take place on the evening of June 23, at the chief restaurant of the Orangerie. The technical proceedings at the meeting will occupy the mornings of the next three days, and they have been provisionally arranged as follows.

Tuesday, June 24: Opening of the meeting, and inaugural address of the President, Herr Reese, followed by reading and discussion of the following papers: "Present Position of Modern Methods of Sterilizing Drinking Water," by Dr. Gärtner, Professor at the University of Jena; "Gasholders," by Herr E. Körting, General Manager of the Berlin Works of the Imperial Continental Gas Association; "Gas and Hygiene," by Professor von Gruber, Doctor of Medicine of Munich; "Flameless Surface Combustion," by Dr. H. Bunte, Professor at the Technical College at Carlsruhe; and "Removal of Carbon Bisulphide from Gases, with Observations on the Athion Process," by Dr. Knoevenagel, Professor at Heidelberg, and Herr Kuckuk, the Manager of the Heidelberg gas undertaking.

Wednesday, June 25: Reading and Discussion of the following papers: The Water Supply of Alsace," by Herr Timme, Privy-Councillor of Strasburg; "The Geological and Underground Water Conditions of Alsace," by Dr. Feeser, of Strasburg; "Experiences in the Use of Aluminium Sulphate for Clarification at the Elbe Water-Works at Hamburg," by Herr R. Schröder, of Hamburg; "The Phenomena Connected with the Destruction of Pipes and their Bearing on the Material to be Adopted," by Dr. O. Kröhnke, of Wilmersdorf, near Berlin; and "Main Pipes from the Technical and Industrial Aspect," by Herr Schomburg, of Gelsenkirchen.

Thursday, June 26: Reading and discussion of papers—viz.: "The Technical Development of the Gas-Producer Furnace" by Dr. Karl Bunte, of Carlsruhe; "Modern Boiler-House Working;" by Herr Göhrum, Manager of the Stuttgart Gas-Works; and "The Gas-Fire in Trade and Industry," by Herr Albrecht, of Berlin. Presentation of the Reports of the Technical Committees of the Association dealing with: (1) Gas Meters, (2) Standardization, (3) The Working of Water-Works, (4) The Experimental Gas-Works, (5) The Working of Gas-Works. Private business, including the presentation of the annual report of the Association, the Simon-Schiele Award, the report of the Benevolent Fund, and the election of officers for the ensuing year, will be taken on this day.

The other arrangements made include: On the Tuesday afternoon, choice of a visit to either (1) the Corporation reservoir at Oberhausbergen, (2) the gas-works, where the stoking machinery will be inspected, (3) the electricity works, or (4) the Stockfeld Garden Suburb. In the evening there will be a special performance in the municipal theatre. On the Wednesday afternoon, visits to (1) the wharves, (2) the extensions of the hospital, with central heating from a distance, (3) the "Danubia" Gas and Meter Works, and (4) the "Niederburg" laundry, in which high-pressure gas is used. In the evening there will be an illumination of the Castle. On the Thursday evening, the banquet will take place in the chief restaurant of the Orangerie. Friday, June 27, will be devoted to a whole-day excursion, starting by special train to Wanzel, whence three alternative routes and schemes may be followed according to choice.

ASSOCIATION OF GAS AND WATER ENGINEERS OF AUSTRIA-HUNGARY.

Annual General Meeting.

The proceedings at the thirty-second ordinary general meeting of this Association, which was to be held at Vienna last week, included the following items.

On the evening of Thursday, there was a reception and assembly in the "Grünen Tor" Reception Rooms.

On the Friday the technical proceedings were to take place in the banqueting hall of the Austrian Engineers' and Architects' Association, the inaugural address being delivered by the President, Dr. Franz Heltai, of Budapest. After the presentation of the annual report, the following papers were to be read: "The Vienna Corporation's New Gas-Works at Leopoldau," by Herr F. Menzel, the Manager; "Working Results of a Woodall-Duckham Experimental Retort-Setting," by Herr E. J. Bernauer, of the Budapest Gas-Works; and "Recent Working with Charging Machines and Turbo-Exhausters," by Herr E. von Geissler, the Manager of the Pressburg Gas-Works. After lunch, there was

an excursion, which included visits to the Leopoldau Gas-Works and the Hungerberg water reservoir.

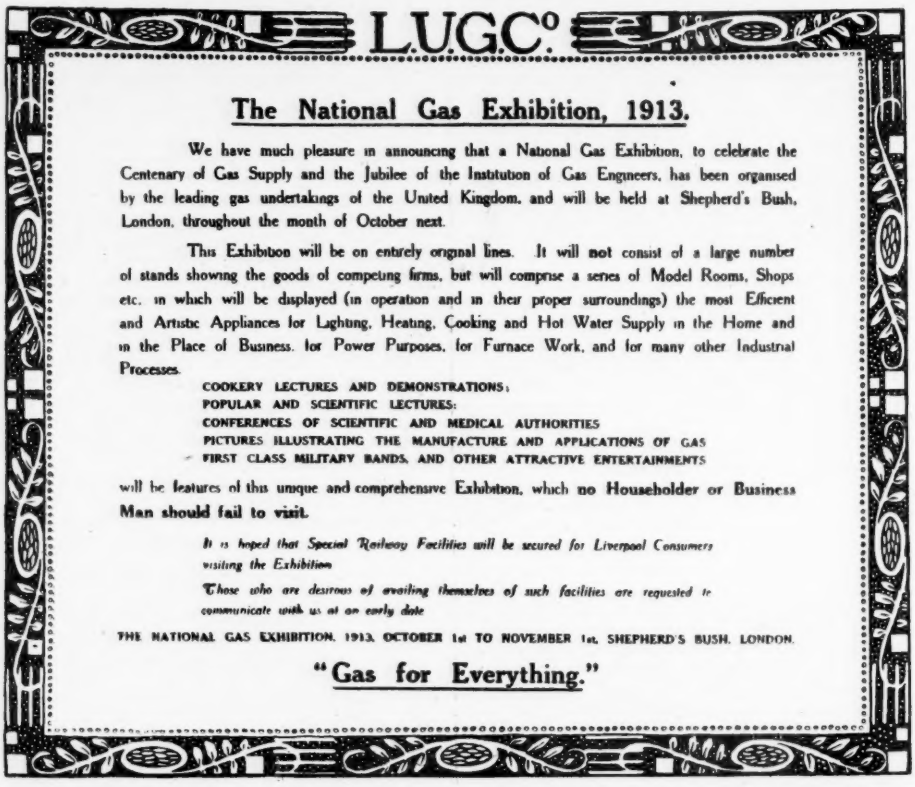
On Saturday, after transacting private business, including the election of the President and other officers for the ensuing year, the following papers were down for reading: "The Development and Extension of Central Water Supply," being the report of the Water Supply Committee, presented by Herr A. Swetz, of Vienna; "Railway-Carriage Lighting," by Herr W. Gorlitzer, of Vienna; "New Applications of Pharos High-Pressure Gas Lighting and Heating," by Herr P. la Ruelle; "The Rutter Safety Gas-Meter," by Herr A. M. van Deventer, of Hallein; and "Autogenous Welding, and Especially its Application in Gas-Works," by Herr Friedmann, of Vienna. The reading of the papers was to be followed by a discussion of gas topics of the day, and in the afternoon an excursion had been arranged to the Exhibition of Gas Apparatus in the Administrative Offices of the Vienna Corporation Gas-Works. In the evening the banquet of the Association was to take place; and for Sunday last an informal visit to the Adria Exhibition in the Prater at Vienna was planned.

NATIONAL GAS EXHIBITION.

A Good Suggestion for June Gas Accounts.

Accompanying this is a reproduction (on a smaller scale than the original) of the back of the account forms that will be sent to the customers of the Liverpool United Gaslight Company for the June quarter. The wording and general idea is, we believe, due to Mr. F. W. Goodenough and the other active workers of the British Commercial Gas Association.

It will be seen that the matter advertises the forthcoming National Gas Exhibition; and Mr. Goodenough's view is that other gas undertakings may like to copy this, in order to give to the exhibition as much publicity as possible within their areas. On the front of the account—where the consumer's obligations are noted—there appears in red ink a suggestion to turn over and see what is said about the exhibition on the other side.


LUGC°

The National Gas Exhibition, 1913.

We have much pleasure in announcing that a National Gas Exhibition, to celebrate the Centenary of Gas Supply and the Jubilee of the Institution of Gas Engineers, has been organised by the leading gas undertakings of the United Kingdom, and will be held at Shepherd's Bush, London, throughout the month of October next.

This Exhibition will be on entirely original lines. It will **not** consist of a large number of stands showing the goods of competing firms, but will comprise a series of Model Rooms, Shops etc. in which will be displayed (in operation and in their proper surroundings) the most Efficient and Artistic Appliances for Lighting, Heating, Cooking and Hot Water Supply in the Home and in the Place of Business, for Power Purposes, for Furnace Work, and for many other Industrial Processes.

COOKERY LECTURES AND DEMONSTRATIONS;
POPULAR AND SCIENTIFIC LECTURES;
CONFERENCES OF SCIENTIFIC AND MEDICAL AUTHORITIES
PICTURES ILLUSTRATING THE MANUFACTURE AND APPLICATIONS OF GAS
FIRST CLASS MILITARY BANDS, AND OTHER ATTRACTIVE ENTERTAINMENTS

will be features of this unique and comprehensive Exhibition, which **no Householder or Business Man should fail to visit.**

It is hoped that Special Railway Facilities will be secured for Liverpool Consumers visiting the Exhibition.

Those who are desirous of availing themselves of such facilities are requested to communicate with us at an early date.

THE NATIONAL GAS EXHIBITION, 1913, OCTOBER 1st TO NOVEMBER 1st, SHEPHERD'S BUSH, LONDON.

"Gas for Everything."

INCOME-TAX.

[Communicated.]

An exact knowledge of the relative positions and powers of the officials and bodies to whom the administration of income-tax is entrusted is of considerable advantage in securing a just assessment on gas-works.

Commissioners.

It cannot be too generally understood that the Commissioners are, in practice, as despotic and supreme as a Judge. Their decisions can only be reviewed in the Courts, and then not on a point of fact but only on a point of law. As is well known, gas companies have the option of being assessed by the Special Commissioners or the General Commissioners. The former paid body is partly composed of revenue officials promoted from lower grades; and therefore there is the possibility of official bias when considering a question which is left by law or practice to the Commissioners' discretion. This is in direct contrast with the action of a strong body of General Commissioners, who are an honorary board of local men of standing, and generally of extensive commercial experience.

Not only is the sole control of income-tax vested in the Commissioners, but they possess discretionary powers of a very extensive degree, and are able, in many cases, to relieve the taxpayer on a hard technical point. But such concessions must be asked for from the Commissioners, as they will not be offered. The General Commissioners are not under the orders of the Board of Inland Revenue; but the Special Commissioners, being a paid Government Department, are in a different position.

Surveyors of Taxes.

Surveyors of taxes in some cases are considerate of the rights of the public; but in many instances their sole aim is "revenue," and much inconvenience and monetary loss are caused by the prevailing policy of obscuring the beneficent provisions of the Income Tax Acts. The complexity of the latter permits this practice to continue. The surveyor will sometimes raise a point which, though legally correct, is equitably grossly unfair; and unless it is known that the Commissioners may, by practice, in several cases ignore such technical point, the taxpayer is apt to accept as conclusive the surveyor's protestations, by letter or interview, prior to an appeal meeting. But if such circumstances arise, the matter should be placed before the Commissioners, either personally at a meeting or through their Clerk. When it is grasped—and official experience shows that it is very little known—that the Commissioners have such extensive powers (which fact is admitted by the Crown), much of the inequity attached to the income-tax will be seen to disappear. Surveyors are, however, apt to argue as if such powers were non-existent; and as the General Commissioners have no material knowledge of the law and practice, being comparable with Magistrates—who, however, have considerably more actual experience—it is necessary for the appellant, in case he desires an equitable construction, to confront the Commissioners and the surveyor with the statement that the Commissioners have sufficient discretionary powers to mitigate the hardship in question.

Surveyors of taxes are, of course, experts in the law of income-tax, and, in addition, they have a great advantage in knowing the practice, which is to such a large extent unwritten and not uniform—a state of affairs caused, *inter alia*, by the Commissioners being divided into so many separate and distinct bodies. The appellant, when dealing with an inequitable technical point, should urge the Commissioners to decide equitably instead of legally; and it will be found in many instances that the Crown will not oppose such decision by demanding a case for the opinion of the High Court.

Appeals.

A particularly bad practice in some districts, and which exists

because it is not efficiently opposed, is that of the Commissioners, sometimes on the quiet request of the surveyor, requiring the appellant to retire while the decision is arrived at. The surveyor remains, and, in the absence of the appellant, continues his arguments. The rank injustice of such a proceeding is, of course, apparent; and any gas official meeting with such a requirement should strenuously contend that the surveyor ought also to be compelled to retire. The surveyor has, however, statutory powers by section 57 (7) of the Taxes Management Act, 1880, to be present during the determination of the appeal, and will naturally rely on such powers. But if the injustice of the matter is brought strongly to the notice of the Commissioners, the request for retirement will probably be withdrawn. It is, of course, unwise for the appellant to refuse to retire without giving his reasons, as any unqualified objection would prejudice his case.

The appellant should be warned against accepting the promise that the surveyor shall not take part in the discussion in the former's absence, as this undertaking is not always adhered to.

Assessment.

Gas-works, although classed as being under Schedule D, which covers practically all profit-making concerns, are in reality assessable under No. III. of Schedule A. But by the Revenue Act of 1866 the rules of Schedule D are to be introduced, when such rules are consistent with No. III. of Schedule A. Over-diligent surveyors, by alleging inconsistency, may urge that certain beneficent rules of Schedule D are inapplicable to gas-works; but the question should be strenuously debated before the Commissioners, who are able to mitigate many inequitable constructions. There is a little-known sweeping clause of great importance to gas-works contained in section 188 of the Income Tax Act of 1842 which enacts that:

> "Every provision in this Act contained, and applied to the duties in any particular schedule, which shall also be applicable to the duties in any other schedule, and not repugnant to the provisions for charging, ascertaining, or levying the duties in such other schedule, shall, in charging, ascertaining, and levying the same, be applied as fully and effectually as if the application thereof had been so expressly and particularly directed, anything herein contained to the contrary notwithstanding."

It should be argued that repugnancy must be construed as being limited to provisions which clash with a particular rule relating specifically to gas-works, and to provisions which, by reason of the constitution of gas-works, cannot possibly be applied to the latter.

Obsolescence.

There is no statutory allowance for the value of machinery which has had to be scrapped owing to the introduction of more up-to-date machinery. Some years ago, however, representations were made to the then Chancellor of the Exchequer by the Association of Chambers of Commerce, and the Chancellor stated that no objection on the part of the Revenue was to be taken "to the allowance, as a deduction from the assessable profits of the year, of so much of the cost of replacement as is represented by the existing value of the machinery replaced." This statement therefore is binding on surveyors in so far that any objection they might raise to such allowance would not be supported from Somerset House; and the Special Commissioners, being salaried officials, would also accept such ruling. The General Commissioners are, however, free to reject it if they wish, so that if a large claim arises it would be advisable, in the event of the deduction not being agreed with the surveyor, to interview the Clerk to the General Commissioners and ascertain the Commissioners' attitude. If it is unfavourable, notice of appeal to the Special Commissioners should be given within ten days from the date of the notice giving the amount of assessment.

Unfortunately, the Chancellor's action has not been made known officially to the General Commissioners, and the Departmental Committee of 1905 reported that "it appears that, although the letter (mentioned above) was published at the time, no very formal steps have been taken, either by the Association of Chambers of Commerce or by the Revenue authorities, to keep the concession which it offered before the minds of manufacturers and of the several bodies of General Commissioners, and, in consequence, a large amount of ignorance seems to prevail in regard to it. This is true also as regards the subject as a whole; and the author thinks that effective steps should be taken both to make the law itself clear and to give the public reasonable facilities for ascertaining their rights and obligations."

The latter part of the report bears out the above statements as to the action of the Revenue Authorities in maintaining an attitude of reticence on the question of concessions and provisions which are to the taxpayers' advantage.

Depreciation.

The question of allowances for depreciation in regard to gas-works has been extensively considered, and, as is well known, the terms of the Acts only refer to machinery and plant, thereby excluding buildings. A Departmental Committee on Income-Tax reported that the assessment on the annual value of buildings under General Rule 1 of Schedule A allows a deduction of one-sixth for repairs, and that such deduction covers depreciation. The Committee had, however, in the case of gas and water works, overlooked the fact that there are no such assessments on the annual value of buildings as with ordinary concerns primarily under the rules of Schedule D. Even the latter, in the result, are on the same footing, as, in arriving at the assessable profits, the net Schedule A assessment *plus* the actual repairs is allowed; whereas with gas and water works only the actual repairs are deducted, as there is no Schedule A assessment on which duty is separately payable. There is no legitimate reason why depreciation of buildings—in fact, of all physical matters connected with gas-works which are capable of depreciation—should not be made legal; and the question should be persistently put forward in Parliament.

Allowances for depreciation of meters, stoves, and gasholders having been obtained, the case of mains is in evidence at the present time; and though the Crown urges that actual renewals alone should be deducted, a reasonable rate of depreciation should be demanded, as renewals are too much a thing of the future. In the event of any renewals exceeding the proportion of depreciation allowed, the balance should be claimed as a deduction.

It may, of course, be contended that the allowance of actual renewals of machinery and plant is better than an estimated amount for depreciation; and in cases where the obtainable deduction for the latter is too low, the former may be preferable. It should, however, be understood that in the case of any new plant being laid down it may be a considerable time before any material renewals will be required. Gas-works may take either depreciation or renewals; and it is well to estimate the latter and compare them with the depreciation which would be allowed by the Commissioners, and then select the financially better method.

The percentage rate of depreciation of machinery and plant is a point productive of considerable dissatisfaction; but it should be borne in mind that the Commissioners are empowered to "allow such deduction as they may think just and reasonable as representing the diminished value by reason of wear and tear during the year." It will thus be seen that the Commissioners are able to make what allowance they think fit; and so long as they restrict such allowance to "machinery and plant," their decision cannot be reviewed by the Crown even in the Courts, as the question is one of fact, not law. The General Commissioners are, as a rule, men of considerable commercial experience; and if the matter is efficiently placed before them, a proper deduction should be obtained, provided that the appellant can satisfactorily counteract the domineering persistence of the surveyor by keeping before the Commissioners the important fact that the rate of depreciation is only limited by justice—a fact which the surveyor is careful not to emphasize. In short, the allowable depreciation is that which is commercially correct.

Clerks to Commissioners do not in all cases make a statement of the law involved for the information of the Commissioners; it therefore lies with the appellant to supply this deficiency. It should be noted that any circulars issued to surveyors from Somerset House, and which restrict allowances, are in no way binding on the General Commissioners.

Cases Stated.

The statutory provisions in regard to cases stated by the Commissioners for the opinion of the High Court only provide for questions of law—all decisions on points of fact being final and conclusive. This is of particular importance; and if a gas company intend demanding a case in the event of lack of satisfaction at the appeal meeting, great care should be exercised in regard to the actual findings of the Commissioners, and it should be seen that the facts involved are not interwoven with the legal points so as to give the Court power to determine the facts. It is essential that the findings should be agreed in terms before the appellant leaves the meeting, as this will ensure these findings being stated in the ultimate case. This course will prevent any dispute when the draft case is submitted to the appellant and surveyor for agreement of the facts, as is usually done.

It is essential to obtaining a case that dissatisfaction with the determination of the Commissioners, as being erroneous in point of law, be expressed immediately upon such determination.

Waggons.

It has recently been decided in the Courts on a mining case that the portion of payment for waggons on a hire-purchase arrangement, which does not represent purchase but merely hire, is an allowable deduction.

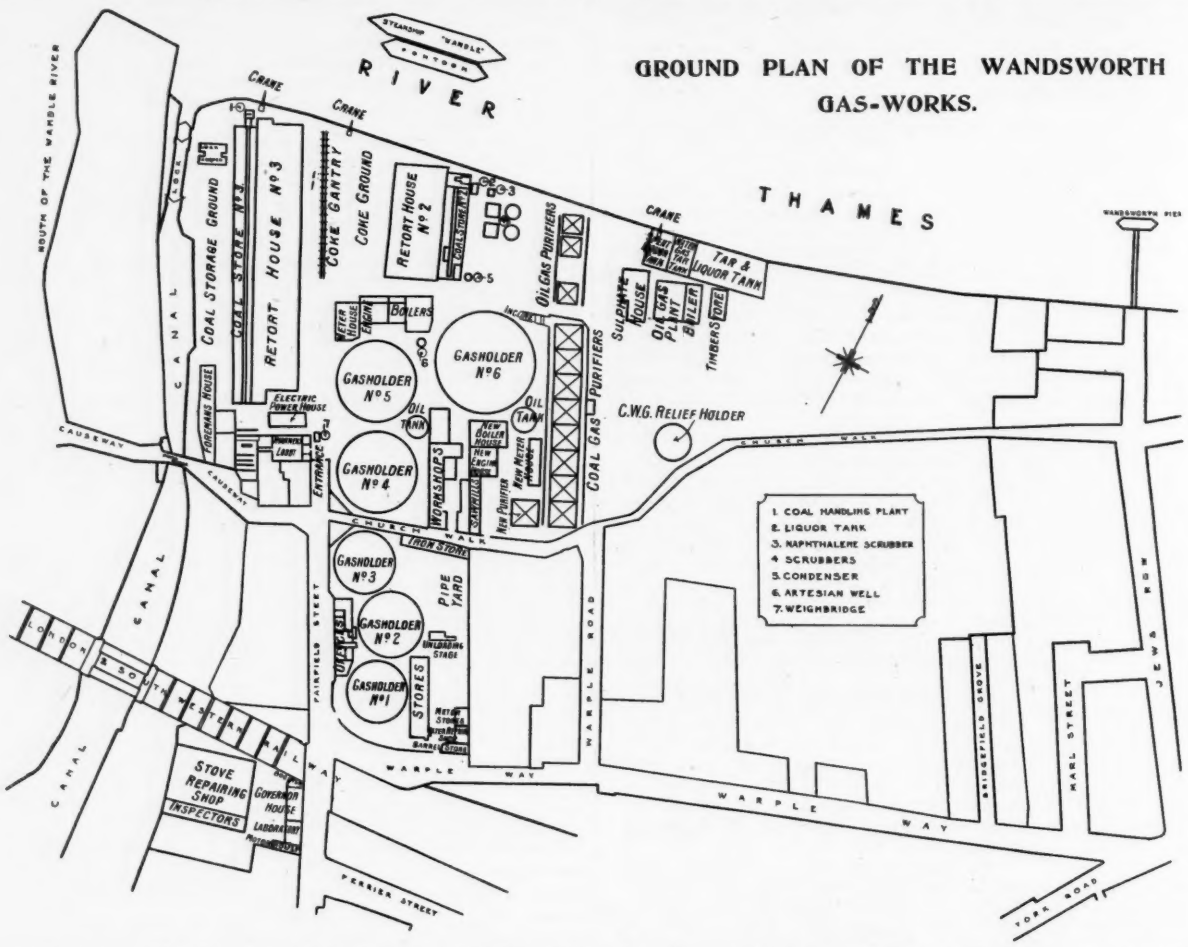
Excursion of the Scottish Junior Gas Association (Western District).—The members of the Western District Section of the Scottish Junior Gas Association journeyed to Innellan on Saturday afternoon on the occasion of their second annual excursion. The weather, if dull, was dry and pleasant. The party numbered about forty ladies and gentlemen. On arrival at Innellan, tea was served in the Town Hall; the party afterwards adjourning to the seashore, where games, &c., were indulged in. Before going on board the boat for the return journey, the party reassembled in the hall where tea was served, and a pleasant half-hour spent with songs and pianoforte selections. Mr. John Wilson (Falkirk), the President, addressing the members, said that though their number might have been greater, a more pleasant and enjoyable afternoon could not possibly have been spent. The time had passed all too quickly. The presence of the ladies had contributed much to the success of the outing; and he was sure all would look forward to a similar excursion next summer. After singing "Auld Lang Syne," the party returned to Glasgow by boat and train.

THE SOUTHERN ASSOCIATION OUTING.

Visit to the Wandsworth Gas-Works, and a Thames Trip.

It was a large party of the Southern District Association of Gas Engineers and Managers that boarded the 10.37 a.m. train out of Waterloo last Thursday *en route* for Wandsworth Town Station, thence to the Wandsworth works of the new Wandsworth, Wimbledon, and Epsom District Gas Company, the Chief Engineer of which (Mr. H. O. Carr) is the President of the Association. At intermediate stations, the party was reinforced by fresh comers; among them, at Clapham Junction, being Mr. James W. Helps, whose presence, after his illness, gave infinite delight to his many friends. The morning was a brilliant one; and the anticipations of a day of real enjoyment—technical and otherwise—were fully realized. At the Wandsworth Town Station was a guiding escort from the Wandsworth works, which are only a few minutes distant, and situated, with credit for foresight to those who laid their foundations, and those who have taken opportunity to extend the land-holding of the Company, on the south bank of the Thames. At the works, the members were received in the men's lobby by the President; and a little later came on to the scene the genial Chairman (Mr. H. E. Jones), who claims the President as one of his "boys"—he having initiated Mr. Carr into the mysteries of the science and art of gas manufacture, distribution, and sale. There was also the Deputy-Chairman, Mr. R. Garraway Rice (formerly Chairman of the Mitcham and Wimbledon Gas Company; and of the other Directors, Dr. T. A. Ives Howell, Mr. W. G. Langlands, Mr. Frank H. Jones, and Mr. B. R. Green were seen. The other Directors were unavoidably prevented from being present. It would have been a great pleasure to have had as one of the party Mr. H. S. Freeman, a member of the Board, who spent nearly half his life as Engineer to the Wandsworth Company, as successor to Mr. H. E. Jones. Speaking of Mr. Green, this was the first opportunity several of the members had had of congratulating their fellow-member and ex-President, on his elevation to the Board. Last year, he received them as their President at the works of the Mitcham Company, of which he was then Engineer, and which is an important component of the

GROUND PLAN OF THE WANDSWORTH GAS-WORKS.



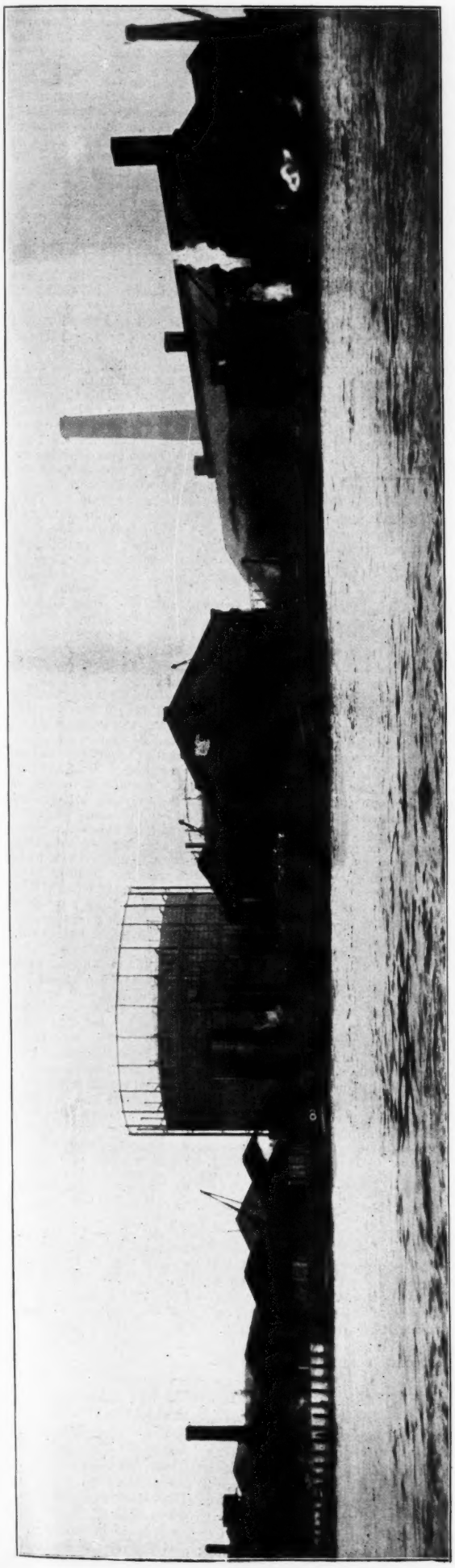
new Company. The Secretary of the Company (Mr. Chas. W. Braine), known, if not to all personally, by name and excellent reputation, to the visitors, was also there, and rendered much help. Mentioning those who worked well and willingly to make the day a success, we must not omit the name of the Hon. Secretary of the Association (Mr. W. E. Price); and that of the Company's Assistant Engineer (Mr. C. M. Croft), and Chemist (Mr. U. O. S. Nairne, F.I.C.). Among the visitors was Mr. Charles Edwards, of Napier, New Zealand.

Round the Works.

There were light refreshments for the visitors in the men's lobby; and while these were being "discussed," personal greetings were taking place. But there was not much time spent here. The visitors were divided into three parties, under the guidance of the President, and Mr. Croft and Mr. Nairne. There is no occasion to particularize in this account all that was seen, as subjoined to the present sketch of the day's doings is a general descriptive outline of the plant prepared by Mr. Carr.

First a visit was paid to the new power house, from which the electrical requirements of the works are met. The generating plant incorporates two "National" gas-engines and one Crossley engine. About the last-named Mr. Carr pointed out a novel feature. The engine has an additional cylinder at right angles to the main one, which has a sleeve in it. The area in the additional cylinder is regulated by a governor on the engine. By the increase or decrease of the area, the explosion is also increased or decreased. In this way the energy is governed to the amount of work to be done. The whole result is that it gives a very steady voltage, especially adapted for such an apparatus as a booster. The other engines are governed; but the area of the cylinders is not variable. They only therefore take an explosion when necessary, with the result that the voltage varies to some extent. If the voltmeter is observed, it is noticed that the indicating hand jumps to a certain extent; but this is practically unnoticeable with the gas-engine with cylinder regulation.

Then followed an inspection of the conveyor tunnel running underneath No. 3 retort-house coal-store. This tunnel was described by the President in his Inaugural Address earlier in the year, and is further mentioned in the subjoined description of the works. At a breach in the tunnel, the rotary travelling filler was witnessed at work. Incidentally, too, Mr. Carr explained what is projected in the way of a new coal storage scheme. On the opposite side of the walk along which the visitors were passing is a canal which the Company have acquired, and the origin of which was explained. It is now used for conveying sundry materials to the works; but the schemes for the future may comprehend greater use. By the side of this canal, the party passed round to



THE RIVER FRONTAGE OF THE WANDSWORTH GAS-WORKS.

the front of No. 3 house; and the coal-conveyor was again seen, with coal-breaker and crane. Attention was called to the two buoys where the Company's steamship *Wandle* moors, and where the pontoon with two cranes, is permanently situated. Then the party entered No. 3 house, which is a spacious one, and saw extensions in progress.

Here, as in other parts of the works, the extensions in hand are due to the expansion of business in the amalgamated area. The Wandsworth works are, as a matter of fact, taking up the extra business not only in their own but in the Mitcham and Wimbledon areas. In the ordinary course of things, if there had been no amalgamation, the Mitcham works would have had to be promptly and considerably extended. Next winter, the Mitcham works may have to put into the mains the whole of their output of gas; and then, on the completion of the present Wandsworth extensions, the Board and their Engineer will make a selection from the schemes they have under consideration for further supplementing the producing power at the Wandsworth works, where the transferring of coal direct from the Thames into the retorts must result in the attainment of the highest point in economical working. The extensions in No. 3 house consist of six beds of ten retorts, 24 in. by 16½ in. (with curved bottoms), and 21 feet long. Roughly, these will together turn out about a million cubic feet of gas per day, using 14 cwt. charges. Each retort has two ascension pipes, which Mr. Carr considers preferable with the De Brouwer projectors—as the double pipes relieve the retorts of any pressure in case of blocking in the middle. In the old retorts in the same house, about 10 cwt. charges are the rule. Next winter the greater part of the old No. 2 retort-house will also have to be used, with its direct-fired settings. Mention of this led to the inquiry as to what is to happen in the future in the matter of the system of carbonizing plant. Mr. Carr's reply was a very guarded one. He really does not yet know. The matter is under discussion. It may be that the old direct-fired settings of sixes may be pulled out, and a fewer number of settings of tens be built with regenerator settings, making the old house into a stage-floor one. There is also the possibility of an inspection of the best and most economical form of vertical retort working being made; and so there is an equal chance of verticals going direct upon the site of the direct-fired horizontals. A third course would be to leave the present No. 2 retort-house as a stand-by, and build a new retort-house in another part of the works. These, however, are schemes that are matter for determination in the Board room, in conference with the Engineer.

The old engine and boiler house was in course of demolition, as operations have been commenced for its transfer to a new site further away from the river, in order to provide more room hereabouts for the storage of coke. Other plant was inspected; and their features were pointed out, including the river water-pump, and filter in the river bed. The party came to the purifying plant; and the oxide disintegrator was here the feature of interest. It received prominence in the Presidential Address; and the real thing was now examined. Burnt oxide is mainly used at Wandsworth. This is specially treated, and is put into the purifiers at a cheaper rate than would be the case with bog ore. But the material has the disadvantage of caking very heavily in the purifiers; and this is occasioned to some extent by its greediness for sulphur, which has recently shown as much as 38 per cent. on the first filling of the purifiers. When the material is emptied out of the purifier, it gets into a heated state; and, unless it is put through some such device as the disintegrator, it is very apt to cause inconvenience by firing. The method of working is to empty the purifiers into barrows on the top stage, and tip the material at once into the disintegrator, allowing a stream of water to moisten the disintegrated oxide, so preventing the firing of the sulphur—that is to say, if the oxide in its dry state is used in the disintegrator without being watered, the finely-divided sulphur in suspension in and around the disintegrator is very apt to fire. For instance, a spark in the disintegrator caused by a stone finding its way in with the material might easily cause a mild explosion. The disintegrated material falls into an enclosed hopper under the purifiers; and it is removed thence by a bottom slide feeding into hand carts. By these, the material is spread to the depth of about 3 feet over the cellar bottom under the purifiers. It is then turned over, and loaded into side-tipping trucks of the Decauville type. Then it is raised to the top of the purifiers, across which the trucks are run by three lines of rails; the material being tipped from either side into the boxes and then levelled over. It is found that this disintegrator is very economical compared with former hand labour for breaking up the lumps of material. In cost of labour alone there is a saving—the labour for the disintegrator only costing about one-quarter what the hand labour used to do. The disintegrated material was examined; and the efficiency of the system was seen, and was a point of comment.

The party then went to the new meter-house, exhauster, and boiler-house, mechanics' shops, &c. Completeness in the shops was to be expected; and in mechanical and other equipment, they were found to be all that could be wished for. The visitors had a look into the stores and the governor-house. There was a little lingering in the stove-shop, where old stoves are turned out as new. They are baked entire in an oven—afterwards being brushed down and repainted (an idea borrowed from Mitcham works). The tinning plant was a central feature. There was not much of interest about the plant that escaped notice. Among other points gathered by the way, was that, with the enlarged Company, the Board meetings are now being held at Westminster; and the old

Board-room at the Wandsworth offices is to be turned into the rental office. The present show-room at the works is also to be extended; and the Engineer and his staff will in future find habitation in the former rental apartments on the ground floor of the offices.

Luncheon and Two Toasts.

Kindly provided by the Chairman and Directors, the visitors were entertained at lunch in the old Board-room. Mr. H. E. Jones presided, and had in the place of honour the President, with to the right and left hand sides the directorial colleagues already mentioned, the Secretary of the Company, the Hon. Sec. of the Association, and some of the principal visitors. The Chairman, in his customary happy manner, heightened the brightness of the function, both by speech and incidental remark. Proposing the first toast—"The Southern District Association of Gas Engineers and Managers,"

The Chairman said it was a great pleasure to him personally to be in the position that day of representing the Board of the Company. His colleagues and himself were glad indeed to welcome the members to take their mid-day refreshment with them; and they heartily hoped that, favoured as they had been to the present with fine weather, the excursion along the Thames during the afternoon would be a pleasant one. The value of the Association was much appreciated by his colleagues and himself. They recognized that it was by their mutual conferences and discussing points of interest in their various practices, and by their meetings, that they advanced the scientific future of the whole industry with which they were connected as directors in the commercial sense, and in which their guests were interested in the higher sense of professional prestige and scientific progress. Gratifying to him as Chairman and to his colleagues of the Board was the fact that the presidency of the Association was held by their technical officer, Mr. Carr. He was reminded that only last year the leading officer of the then Mitcham Gas Company (Mr. B. R. Green) was the President of the Association. He (Mr. Jones) thought the Wandsworth, Wimbledon, and Epsom District Gas Company were particularly indebted to the Association for the great distinction conferred upon the technical gentleman who were connected with the Company. Mr. Carr was their real host that day; he (the Chairman) being only a sort of make-shift. They would also have learned from the book describing the works and plant at Wandsworth, that Mr. Green had already been co-opted to the Board of the united Company. Mr. Green having been one of the Past Presidents of the Association, he (Mr. Jones) was sure this would give the members pleasure and pride. [Cheers.] He had always held with that distinguished man, and his late friend, Sir George Livesey, that the proper avenue to a directors' chair was an upright and proper professional career. Sir George showed them that there need be no limit to the ambition of any gentleman who was prepared to address himself earnestly to the work of his profession. There had been precedent for that. In the case of his (the Chairman's) own father and later himself, they had been awarded seats at the Board of the Company which they had both officially served. In his own case, his position in connection with the Wandsworth Company was won entirely through him having been the Manager of the then small works of the Company. What was now the stove-shop on the works was the first retort-house that he (the Chairman) had ever built. However, he would not detain their guests with reminiscences. It was a great personal pleasure to him and his colleagues to come there, and see so many friends assembled round their President. Mr. Carr was one of what he called his "old boys." As a pupil, he trained him. His father, who was the Engineer of the London and India Docks Company, asked him (the Chairman) if he would father his son. He did so, and the son had turned out well. He was quite a good all-round man, and was a soldier. He was a member of the Honourable Artillery Company; and he had fostered round him a number of territorials—servants of the Company—and there were also a number of reservists at the Mitcham works. Both the Mitcham and the Wandsworth Companies always permitted proper relaxation for their military duties, without loss, to those who were connected with the Territorial service. He thought it was the duty of undertakings employing a large number of men that they should allow those men a fair amount of time who were being trained for the defence of the country. [Hear, hear.] Those present would agree with him that Mr. Carr, in this combined new undertaking (which covered 41 square miles of improving and developing district) had great opportunities and responsibilities; and he showed every disposition to meet those opportunities and responsibilities with the success that had illustrated his career up to the present day. He coupled with the toast the name of the President.

The President thanked the Chairman for doing him the honour of coupling his name with the toast. Having pointed out that the members had been heartily drinking to their own good health, he remarked how at the present day such Associations were necessary to the gaining by them in their professional life of an extensive knowledge. Their duties not only involved the making of gas but many other things. They had to be gas engineers in the first place, and had sometimes to be civil engineers—or as "civil" as they possible could be under very trying circumstances. [Laughter.] They had also to come out of their shells and enter into electrical engineering, as electricity was becoming more and more rife in gas-works for the driving of certain machinery. Besides this, they had to have a close acquaintance with many other scientific and commercial affairs. He thought they had a great advantage over the electrical engineer. They did know what gas was; they could analyze and find out its composition. The electrical engineer had never found out exactly what electricity was. They knew that it could shock people; and sometimes they heard it would cook meat. There appeared to be a great controversy going on with regard to the electric cooker; and he thought gas managers ought really to keep their eyes on it. One of the chief sources of income of gas undertakings was cooking. And although perhaps the electric cooker was at present rather a ludicrous object, yet it was capable of great improvement. When they remembered the first stage of the gas-cooker, and what it was to-day, he thought they would agree there was the possibility of as much improvement in the electric cooker as there had been in the gas-cooker. Therefore it behoved them, having got the first footing, to maintain it, and not to allow the electrical engineer with his electric-cooker any chance. So far as he could understand, with a gas-cooker it was possible to really cook meat; with an electric-cooker, the cooking appeared to consist of slowly drying the meat. What he did wish to dwell upon, however, was that in the official positions they occupied, it was necessary to have a great deal of knowledge beyond the mere making of gas. He hoped the members had enjoyed the little function, and their visit to the works, and that something of interest had been found there. He wished to thank the Chairman for his kind remarks—both with regard to the Association and himself. Their Chairman had been an excellent friend to him since he took him (Mr. Carr) in hand at the age of 16. It had been a good thing for him to have been trained by Mr. Jones, who never allowed anyone to slack. He always kept one busy; but it was the sort of business which was really of great interest, and helped to get one along in the world. If it had not been for Mr. Jones, he would not have been occupying the position he did that day. He thanked them all sincerely for the honour that had been done to his Company and himself by the visit.

Mr. T. Glover (Norwich) said the next toast had been entrusted to him. It was "Success to the Wandsworth, Wimbledon, and Epsom District Gas Company." It was rather a long title for a Company; but as their Chairman had said, it covered 41 square miles. [Laughter.] He was sure those present would all heartily respond to the toast, as they were there to honour, as guests, their President and his Company, the Chairman and Directors of which had invited them to lunch, and to enjoy what was to follow. They thanked them most heartily, as well as for having thrown open their works to the members. They were all still learners; and he believed it would be a long time before gas engineers despised the opportunity and value of such visits as the present. They could always learn by seeing how things were done in a different way from that in which they did them themselves. They never knew what was coming along, nor what they would be requiring; and it was so easy, and so pleasant, to pick up suggestions when they were going round works. Those present would like to congratulate the Company on their extremely low capital charges; and those of them whose capital charges were rather higher would be pleased indeed to see how the Company did it. Perhaps they would learn that it was advisable to do as much as possible out of revenue, without showing how it was done in the balance-sheet. [Laughter.] However, the reduction of capital accounts to such low figures as they had here was not a thing that could be accomplished in a year or two; it was a thing that had to be done as a deliberate policy for a considerable period, if the same splendid results were to follow as they saw in the present case. They would also like to congratulate the Company upon having, as Chairman, an old gas engineer. He (Mr. Glover) did not know how many aspirants there were among the guests for the position of chairman of a gas company; but possibly there were a few. He hoped those aspirants might, in due course, fill the position, and as well as it was filled by the Chairman of the Company. [Hear, hear.] It had been suggested that there was a certain amount of danger in having a gas engineer on the directorate, and, as chairman, he might be an embarrassment to the official engineer. In the present case, they could feel that this was not true. The chairman, he believed, was in the position of carrying out the wishes of the engineer; he meant by this that the engineer-chairman was in a position to convert and convince those members of the directorate who were not familiar with what was required. He believed that was how it worked out in this instance. This was a most happy position of things. Such a position existing here, they could drink heartily to the future success of the Company, and wish their old friend Mr. Jones (he ought not to say "old") the best happiness in the years before him. [Applause.]

The Deputy-Chairman (Mr. R. Garraway Rice), in responding, said the Chairman, his colleagues, and himself were much gratified by the opinions that had been expressed so thoroughly and well by Mr. Glover. He (the Deputy-Chairman) occupied rather a unique position on this occasion, because, as the members might remember, last year they visited the Mitcham works, where his friend (Mr. Green), then the Mitcham Gas Company's Manager, and now his colleague on the Board, welcomed them. Since then things had moved very quickly. The Companies had been married; and a very happy marriage so far it had been. Mr. Green had been succeeded at Mitcham by Mr. Carr, who had taken supreme command of the Company's works. He was sure that he was expressing the opinion of the Chairman and his colleagues in saying how pleased they were to see the members at Wandsworth. On behalf of the former, he thanked Mr. Glover for his kind remarks, and their other guests for endorsing them. He hoped that the remainder of the day would be equally as pleasant as the part through which they had passed.

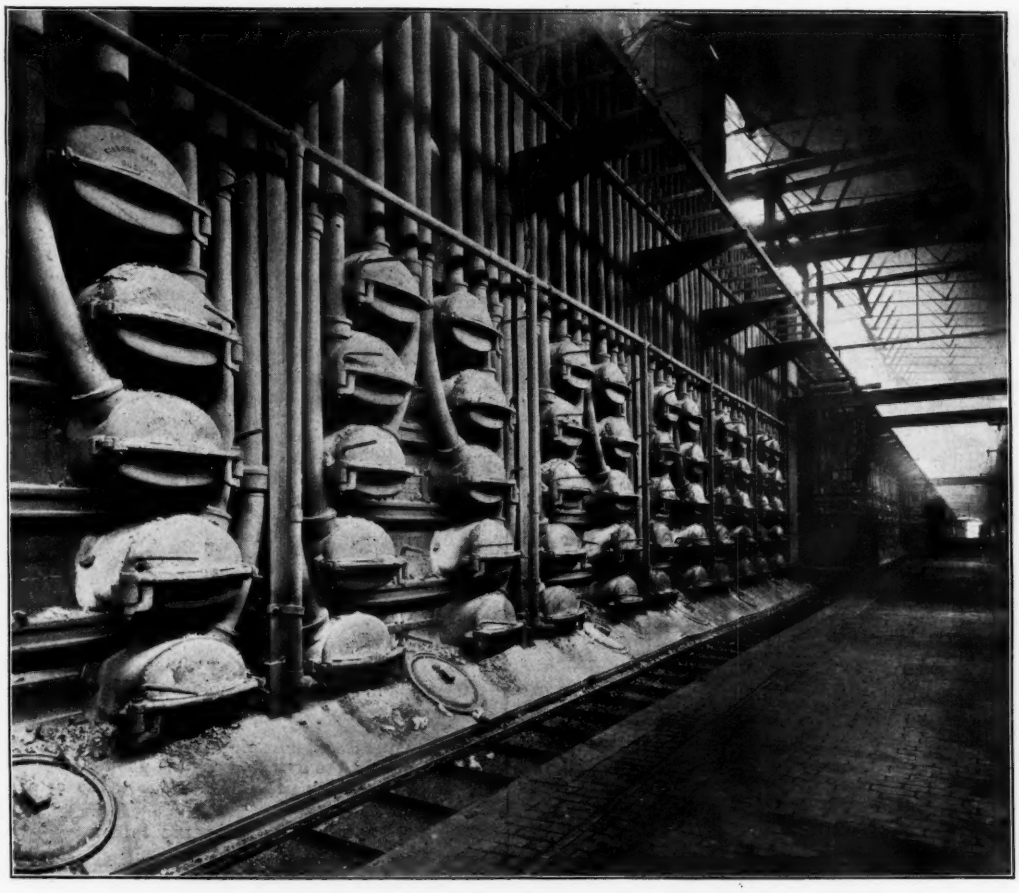
Trip on the Thames.

After lunch, the members boarded a launch lying by the side of the Company's wharf, and had a trip down the river as far as Purfleet, and back to Westminster Bridge. Tea was served on board, and Westminster Bridge was reached about seven o'clock. The trip was much enjoyed; and, as the members parted, they congratulated themselves on the excellence of the programme provided for them, and upon the considerate and perfect contribution of the weather to its success.

DESCRIPTION OF THE WANDSWORTH GAS-WORKS.

[Reprinted from the Souvenir of the Visit.]

It is hardly possible to dwell on the doings of the Wandsworth, Wimbledon, and Epsom District Gas Company as a whole, as the Company is only a sturdy infant of less than six months. The origin of the Company is known to everyone as an amalgamation of the Wandsworth and Putney, the Mitcham and Wimbledon, and the Epsom and Ewell Gas Companies, who all suffered extinction at the end of last year. Confident hope in the future is the watchword of the new Company; and the requirements of

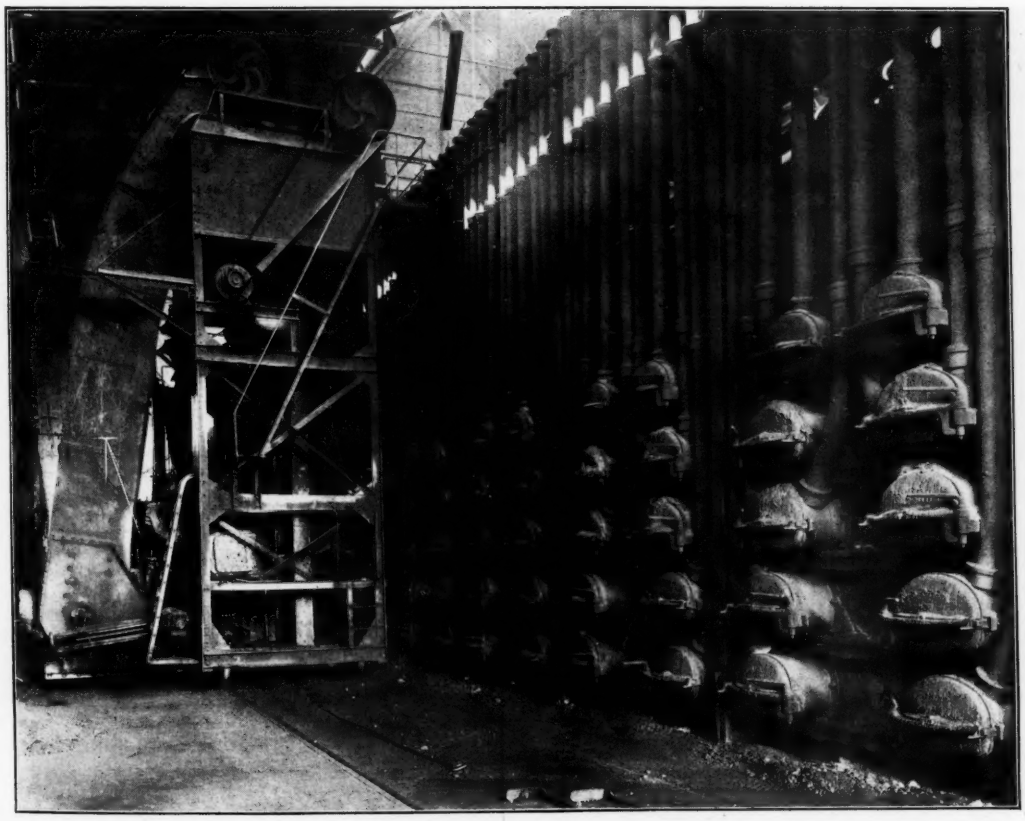


GENERAL VIEW OF NO. 3 RETORT-HOUSE ON THE COKE CONVEYOR SIDE.

the great district now supplied will doubtless give rise to many changes in the Wandsworth works, which may perhaps be a reason why a visit at a future time might not be altogether unappreciated. The old Wandsworth and Putney Company is no more. But its works still stand; and the following brief notes on the past may not be thought inopportune.

The Wandsworth and Putney Gaslight and Coke Company was founded as long ago as 1834, and incorporated by Act of Parliament in 1856. It supplied the old parish of Wandsworth, the greater part of Putney, and a small area in Battersea.

It is unnecessary to give much of its ancient history; but it may be told that it originated through the action of Dr. James



THE DE BROUWER MACHINE—SHOWING THE ELEVATOR, AND THE TAR ASCENSION-PIPES.

Howell, of the town of Wandsworth. He was followed as Chairman by his son, Dr. Thomas S. Howell, who guided the course of the Company for over forty years. Mr. Henry E. Jones, the present Chairman, succeeded him. The Company has been fortunate under such a direction of its affairs; and the results of the labours of the past are revealed in the position attained to-day. Let it be said that the Chairman of to-day began his gas career as engineer at these works. It would tire to tell of all those who have helped the Company in the days gone by; but the name of Mr. H. S. Freeman, the engineer for nearly thirty years, and now an active member of the Board, should not be forgotten.

The position of the works at Wandsworth is very favourable. Here on the banks of the Thames coal is brought directly by a seafaring collier from the Tyne; and while the adjacent River Wandle was a source of benefit to the town in other days, its namesake, the good ship "Wandle," performs a benefit to the inhabitants in helping them to enjoy the cheapest gas in London.

The area available for works is about 23 acres; and the land was acquired from time to time as opportunity arose. The old order has indeed changed. Riverside cottages, boathouses, wharves have gone their way; and only a year or two ago was absorbed the old dock or basin of the Surrey Iron Railway—known as the railway which first obtained an Act of Parliament (1801), and ran from Wandsworth, on the Thames, to Croydon.

Musing on the happenings of the past is, however, not for us to-day; and we turn to more prosaic matters. The Company received additional powers by their Acts of 1866, 1880 (which brought in the sliding-scale), and 1900, as its continued growth demanded.

A comparison of some figures in "Field's Analysis" of 1881 and in that of 1911 (thirty years later) may be of interest. In the former year, the capital employed was £86,190, in the latter year £392,152; while the gas sold was 173,786,000 cubic feet and 1,160,973,000 cubic feet, and the capital per 1000 cubic feet 9s. 11d. and 6s. 9d., price 3s. 9d. and 1s. 9d. per 1000 cubic feet respectively. These are striking figures. In the last year (1912) of its separate existence, 1,220,175,000 cubic feet of gas was sold, and the consumers numbered 29,332.

The installation of automatic meters and fittings began in 1894; and now 18,528 consumers use gas in this way. The average annual consumption of over 20,000 cubic feet is considered good. The hiring-out of stoves for cooking and heating commenced in 1882; and 26,640 are at present in use, besides many more owned by consumers.

The Company has been fortunate in serving a district which may perhaps be considered one of the best residential suburbs of London; and the low price charged for the gas has undoubtedly benefited consumer, shareholder, and profit-sharing employee.

After these prefatory notes, a description of the works will doubtless be turned to with pleasure and perhaps some little profit.

Wandsworth Gas-Works.

The following particulars of the Wandsworth Gas-Works may be of interest. The area of the land at Wandsworth is about 23 acres, with 1250 feet frontage on the River Thames. About 11 acres is occupied by the present works—leaving for further extensions about 12 acres, which includes a dock and wharf communicating directly with the River Thames.

The present manufacturing capacity of the works, including six new sets of ten retorts now nearly completed, is as follows:—

	Cubic Feet per 24 Hours.
Coal gas	7,000,000
Carburetted water gas	1,800,000
Total	8,800,000

The maximum output so far has been 5,657,000 cubic feet per 24 hours. The maximum output for one hour has reached 482,000 cubic feet.

Coal Transporting and Handling Plant.

The coal is carried from the North by the Company's own collier, the s.s. "Wandle," which carries about 1200 tons per voyage. A second collier, the s.s. "Mitcham," carrying 1500 tons, will shortly be launched. These steamers have been specially designed to enable them to pass under seventeen Thames bridges as far as Wandsworth. Here they can be discharged each in one tide by means of two powerful steam-cranes on a large floating pontoon moored some distance out from the wharf—the rate of discharge being about 170 tons of coal per hour. The coal is discharged into barges and into the pontoon itself. The barges are placed alongside the respective retort-houses as required, and are unloaded by large steam locomotive cranes fitted with grabs lifting 30 cwt. of coal at a time. These cranes run on metals, which are laid the entire length of the river front. The coal is delivered into the gravity-bucket conveyor and received into the coal-stores.

No. 3 Retort-House and Coal-Store.

The larger, or No. 3, retort-house is a building partly of brick and partly of steel and corrugated iron. It is 377 feet long, 65 feet wide, and contains 35 beds of ten's, made up as follows: Two benches each of twelve settings and one bench of eleven settings, each containing ten retorts, 21 feet long. The retorts range in size from 21 in. by 15 in. to 24 in. by 16½ in. The settings are of the regenerative type, with single furnaces all arranged on one side of the sets only. Each bench is provided with four tar-towers, which are connected to hydraulic mains specially designed to draw off the tar at the lowest point of the hydraulic main. This point is situated in the middle, and in the newer settings and those under construction at the back of the hydraulic main.

The coal-store runs the entire length of the western side of this retort-house, and is capable of holding about 7000 tons of coal. An additional coal-store, running next to, and parallel with, the present one, has been decided upon—to hold about 15,000 tons. The coal running through the apertures of the present coal-store will be stored by means of a powerful steam-crane and 30 cwt. grab running on a high gantry of steel. When required, the coal will be replaced in the first store by means of shoots through the roof. The present store is filled by means of a gravity-bucket conveyor fixed to the roof scantlings on top and returning through a tunnel the entire length of the coal-store. The conveyor is fed by cranes on the river front, which discharge their grabs into a hopper fixed outside the house. The coal passes through the hopper over a jigger-screen and coal-breaker, and thence to the conveyor by means of a special rotary filling machine. This conveyor deals with 60 tons of coal per hour.

The tunnel is of considerable use in trimming coal from one portion of the store to another, and in turning over the heaps of coal in case of any threatened spontaneous combustion—thus preventing fires. This process is effected by means of a slide fixed in the crown of the tunnel, admitting the coal into a travelling filler, as before mentioned (but mounted on wheels for travelling on rails), which, in turn, feeds the coal into the conveyor. The power for this plant is obtained from a 25 H.P. gas-engine.

Stoking Machinery.

The stoking machinery in use in the house is of the De Brouwer type. There are two charging and two discharging machines. The charging machine has an elevator fixed at the back, enabling it to fill the charging hopper in any position in the retort-house. In order to operate the elevator, the boot is thrust towards the coal-store by means of a screw, and a slide in the coal-store wall is lifted to allow the coal to reach the boot. These machines are driven by electricity generated on the works by means of gas-engines.

Coke-Handling Plant.

The coke-conveying system was put into operation in January last for No. 3 retort-house. It serves 35 beds of ten retorts. It is of the well-known De Brouwer type; but owing to the position of the retort-house, and there not being any room to store coke at either end, the coke has to be stored in the coke yard flanked on either side by a retort-house. The conveyor in front of the retort-beds is split up into three separate working parts, both for convenience in working and to lessen the strain, compared with one continuous conveyor. The coke from each separate conveyor is dropped into a cross-conveyor under the retort-house floor. At the delivery end of each cross-conveyor is a coke pit. Each pit is served with two coke-skips, each holding 1½ tons—the coke falling on to a deflector-plate, and filling the skips alternately on each side of the cross-conveyors.

Two powerful cranes on a gantry 20 feet high, and running parallel to the retort-house, haul up the skips of coke, and deposit them about the middle of the coke yard. The coke is not dropped from the skips, but is quietly allowed to slide out of them—the bottoms being formed of two leaves, which are opened gradually by the crane-driver when the skip is within about a foot of the top of the coke heap. A second winding drum is fitted to each crane. In hauling up, the chain which is attached to the leaves at the bottom of the coke-skip practically takes the whole weight. In emptying the skips, the chain attached to the tops of the skips is made to take the whole weight; and so it follows that the weight of the coke contained in the skip forces open the bottom leaves and allows the coke to slide out.

To close the door after the coke has been emptied, it is only necessary to once more transfer the weight of the skip to the chains attached to the bottom leaves of the skip. The skip is then swung round and dropped into the coke pit for replenishment.

No. 2 Retort-House.

The smaller, or No. 2, retort-house is a brick building, and contains two benches of eight settings of six retorts, which are 21 feet long and 21 inches by 15 inches. They are heated by direct fires, having one furnace on each side of the setting. This retort-house may now only be regarded as temporary till a decision has been made to either modernize it and enlarge its output, or build a new retort-house on another site, to meet the growing demands of the district.

A coal-store, having a capacity of 3500 tons, runs the entire length of the eastern side of the retort-house. It is fitted with the same type of gravity bucket conveyor as in the No. 3 retort-house.

A De Brouwer charging and a De Brouwer discharging machine are installed in this house; and the coke is at present wheeled out by hand barrows.

Condensers.

Large atmospheric condensers, formed of cast-iron pipes suspended from the retort-house walls, are used to cool the gas made in both houses. The gas passing from these pipes to the exhausters is further condensed beyond the exhausters by means

of 24-inch cast-iron pipes (air-cooled) and a water-cooled condenser, having an effective area of 6000 square feet.

Exhauster-House.

The exhauster-house is about to be demolished, and the present machinery will be transferred to a building now partly erected. The present building contains the following exhausters:—

Two each of 100,000 cubic feet per hour two-blade exhausters
Two „ „ 80,000 „ „ „ „
Two „ „ 50,000 „ „ „ „

All are driven by steam generated from two Lancashire boilers 30 ft. by 7 ft. 6 in., situated in a boiler-house adjoining the exhauster-house. A new set of more powerful exhausters and boilers is now on order, and will be installed in the new building.

Scrubbers.

There are four tower scrubbers; two being 20 feet square and 40 feet high, and two being 20 feet diameter and 40 feet high—the total capacity being 53,000 cubic feet. They are filled with wood grids formed of 1-inch die square rods, 2½ inches mesh. The circulating liquor is atomized by the direct force of the circulating pumps.

Naphthalene Extractor.

This is similar in appearance to the tower scrubbers, and is a cast-iron vessel 10 feet square and 30 feet high. It is fitted with spreaders on top as in the case of ordinary scrubbers—the base of the extractor being used as a tank. A pump is fitted outside, and circulates carburetted water gas tar from the tank at the bottom direct to the spreaders at the top, with the exception of about 2 feet top and bottom. The remainder of the extractor is filled with close wooden grids.

Purifiers.

For coal gas there are at present eight purifiers, each being 40 ft. by 36 ft. by 8 ft. deep; and five tiers of oxide are used. They are all in one building, having a revivifying floor in the basement under the purifier-boxes. The total active grid area of these purifiers is 57,600 square feet. An additional purifier of the same size is now being erected. It is intended to break the flow of gas into three separate streams; at present there are only two streams. There are three oil-gas purifiers, 30 feet square by 6 feet deep. The disintegration of oxide is performed by an electrically driven disintegrator, having a 25 H.P. electric motor. This machine is capable of dealing very effectively with 10 tons of material per hour.

Tar and Liquor Tanks.

There are two tar and liquor storage tanks, the smaller situated under No. 2 coal-store. The larger, opposite the oil-gas plant, is underground—the river wall forming one side. The capacity of these tanks is 624,000 gallons. Adjoining the larger tank is the carburetted water-gas tar storage tank of 109,000 gallons capacity.

Meter-House.

The meter-house contains three meters, each capable of passing 100,000 cubic feet per hour; two meters being used for coal gas and one for oil gas. Another meter-house is about to be built on a new site on the works; and an additional station-meter of similar capacity is being erected on the new site.

Gasholders.

The gasholders, six in number, are of the following capacities:—

No.	Diameter.	Lifts.	Capacity. Cubic Feet.
1	85 ft.	2	257,000
2	92 „	2	262,000
3	85 „	2	276,000
4	116 „	2	686,000
5	116 „	2	680,000
6	145 „	3	1,605,000
	Total		3,766,000

Carburetted Water-Gas Plant.

This plant, capable of generating 1,800,000 cubic feet per day, consists of two sets of 900,000 cubic feet. It is of the well-known Lowe system, manufactured by Messrs. Humphreys and Glasgow, and has washers, scrubbers, and water-cooled condensers. An 80,000 per hour Waller exhauster is fixed in the engine-house, together with two Sturtevant fans, driven by high-speed steam-engines. The coke is elevated to the stage floor by a hydraulic lift. The steam is supplied by two Lancashire boilers, 28 ft. by 7 ft. 6 in., situated underneath the engine-house. Two steel tanks provide storage for 270,000 gallons of oil, and are filled by pumping direct from oil-barges. The relief holder has a capacity of 50,000 cubic feet.

Sulphate Plant.

The sulphate plant consists of two stills working on the intermittent system, and connected to a superheater and two Coffey stills. There are two saturators, one with an open front and one fitted with a steam-ejector. The plant is capable of producing about 5 tons of ammonium sulphate per 24 hours. About 60 tons of acid is stored in three acid tanks in the building. The acid is pumped into these tanks direct from barges alongside the wharf opposite. The waste gases are condensed and burnt; the product being absorbed in water limestone towers.

Water Supply.

The supply of water is derived from both the River Thames and from an artesian well, 430 feet deep, sunk in the gas-works. Water is raised from the river by pumps driven by a gas-engine, and the artesian well water is lifted by means of compressed air. No town supply of water has been required for some years.

Electric Power-House.

Electric current for use on the works is generated by two sets of gas-engines coupled direct to two Lancashire dynamos (each plant has an output of 35 K.W. at 220 volts), and one gas-engine coupled to a Lancashire dynamo, and having an output of 30 K.W. at 220 volts. These dynamos are connected to the switchboard in such a way that they can run singly or together in any combination. Part of the electric current is used to drive a "booster" in the governor-house.

Governor-House.

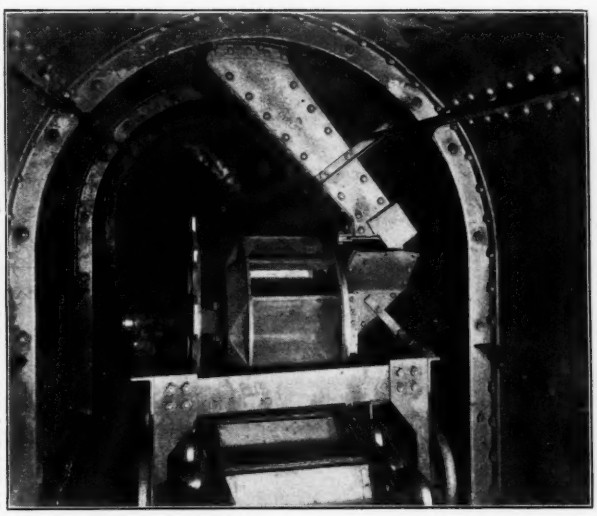
In the governor-house are placed the district governor and a boosting plant of the Keith-Blackman type, capable of raising 500,000 cubic feet of gas per hour 12 inches above the initial pressure of the gasholders. The booster is driven by a 25 H.P. Laurence Scott motor. From this house run the four 30-inch outlet-mains to the district.

Workshops.

The workshops include a blacksmith's shop with six hearths and two power hammers. The fitters' shop contains lathes and drilling machines, planing and shaping machines, &c. The carpenters and the pattern makers' shops are provided with wood-working machinery, circular saw, &c.

Workmen's Lobby.

Near the main gates of the works a lobby has been provided for the use of stokers and other workmen. They include mess-room, washing-rooms, fitted with shower baths, wash-basins, &c.



Travelling Coal Filler in the Conveyor Tunnel.

Ventilated iron-lockers are provided for the men, as well as a drying-room for clothes.

Inspectors' Offices and Stove-Shops.

The inspectors' offices and stove-repairing shops are conveniently situated in a large brick building on the site of the old gas-works. The building was formerly a retort-house known as "No. 1," and had a coal-store running the entire length of each side. One of these coal-stores has been converted into offices for the inspectors and inspectors' clerks, and the main building, including the other former coal-store, is converted into a large stove-repairing shop. Two ovens, made out of two of the original retort-settings, are utilized for burning-off the stoves returned from hire; and a tinning plant is provided for re-tinning the drip-pans, &c.

Gas Supply to the Building Exhibition at Leipzig.

The Leipzig Corporation gas undertaking has put in (the "Journal für Gasbeleuchtung" of May 24 states) an extensive system of distributing mains for the supply of gas to the Building Exhibition which is being held this summer. The system is connected at three points with the town mains, and the gas supplied is to be measured by three station meters. Secondary or check meters will be used for the different services in the exhibition. There will be about 6000 yards of gas-main, in addition to about 1640 yards of high-pressure air-main for the supply of Pharos lamps from a compressor in the chief offices of the exhibition. The two principal thoroughfares will be lighted by 46 compressed-air gas-lamps and 40 high-power low-pressure gas-lamps of 1500 to 2000 candle-power. Gas will be used not only for lighting, but also for cooking and heating in the numerous restaurants, and for power purposes in the Exhibition Hall.

LONDON AND SOUTHERN JUNIOR ASSOCIATION.

Annual Meeting.

The Annual General Business Meeting of the London and Southern District Junior Gas Association was held on Friday, at the Westminster Technical Institute—the PRESIDENT (Mr. D. J. Winslow) in the chair.

ELECTION OF OFFICERS.

The balance-sheet was adopted, and the following were elected as Officers and Council for 1913-14:

President.—Mr. S. A. Carpenter (North Middlesex Gas Co.).
Senior Vice-President.—Mr. J. Hewett (South Metropolitan Gas Company).
Junior Vice-President.—Mr. Ernest Scears (Hampton Court Gas Company).
Council.—Messrs. W. E. Brown, S. B. Chandler, G. F. Cox, F. A. Frost, A. R. Griggs, W. T. Hogg, G. H. Lloyd, W. A. Vanner.
Hon. Secretary.—Mr. Ernest Scears.
Hon. Treasurer.—Mr. E. G. Stewart (Gaslight and Coke Co.).
Hon. Auditor.—Mr. E. G. Merry (Gaslight and Coke Co.).

THE WORK OF THE ASSOCIATION.

The PRESIDENT then submitted some remarks on the work of the Association, which he said had completed its tenth session. A satisfactory point was the increase in membership. At the time of the last annual meeting, there were 152 members and seven honorary members; and since then there had been a net increase of 33. They had to acknowledge the support given by the Patrons and the Senior Association, as shown by the addresses given, the attendances at the meetings, and the works under their control which had been visited. At the meeting in October last, a splendid address was given by Mr. W. Doig Gibb—"A Straight Talk to Young Men," which had given them their watchword, or even ideals, for the session now completed. It was an address which called upon them to make the most of their opportunities. They had the pleasure of support and words of encouragement from Mr. A. F. Browne, Mr. F. W. Goodenough, Mr. F. W. Cross, and Mr. F. J. Bywater, who contributed valuable additions to the address. Another very successful evening was held when Mr. T. Goulden gave an exceedingly interesting address upon "The Progress of Gas Engineering Practice," and dwelt fully on the essential point of "Does it Pay?" The paper was unique, and would form a very profitable addition to the published "Transactions." They had support on this occasion from Mr. Goodenough, Mr. Browne, Mr. Bywater, Mr. Lacey, and Mr. A. A. N. Carpenter. They had thus been privileged to listen to addresses from two of the Chief Engineers of the largest London Companies—an undoubted compliment to the work being done by the Association, in that they had given them of their valuable experience and time. An outstanding feature of the session had been the large installation of Humphrey gas pumps at the new Chingford reservoirs recently opened by the King; and Mr. H. De Birkett, B.Sc., Assistant to Mr. Humphrey, presented a very clear exposition of the principles of construction, together with the working of these pumps, which at the January meeting were fully illustrated by lantern slides and drawings. Mr. Birkett, on behalf of Mr. Humphrey, kindly invited them to visit this important installation at Chingford, which they hoped to do in the near future. A valuable paper was given by Mr. Jacques Abady, assisted by Dr. L. A. Levy, on the "Principles of Gas Testing Apparatus," which the members thoroughly appreciated. It was really surprising to note the great advance that had been made during the last few years in all gas-testing apparatus; the principal one being the recording calorimeter, which had been taken up so well by gas authorities throughout the country—indicating their general desire to know that they were giving gas of uniform calorific value, which was essential to the best interests of both gas authorities and consumers. They had also had three excellent papers by members, and had paid a number of visits. They had yet to visit the works and show-rooms of the Hastings Gas Company; and an interesting programme was being arranged, with the help of Mr. C. E. Botley, the Engineer and General Manager. On the programme for the year, it was announced that a special course of lectures was being arranged at the Westminster Technical Institute. Unfortunately, in consequence of circumstances which were beyond their control, these were not given. They were glad to know, however, that arrangements had now been practically completed for the delivery of the lectures during the coming winter; and the Council trusted that members would avail themselves of the exceptional opportunities that would be afforded. He had to thank them for having elected him President, and hoped that his endeavours to carry forward the high ideals that such an office entailed might have met with some measure of success. He trusted to continue to be an ardent supporter of the Association, and to further its interests whenever possible.

VOTES OF THANKS.

The Officers and Council and the Hon. Auditor were thanked for their services, and

Mr. SCEARS then proposed: "That this annual general meeting of the London and Southern District Junior Gas Association desires to acknowledge and place on record its deep appreciation of Mr. D. J. Winslow's valuable services in conducting and promoting the affairs of the Association during the past year as President, and, upon his relinquishing that office, to wish him every success in his future career. His services antecedent to, and during, his term of office as President have contributed very largely to the prosperity of the Association; and the members desire to tender him their sincere thanks. The resolution to be suitably emblazoned, framed, and presented to Mr. Winslow."

Mr. W. J. LIBERTY, in seconding the vote, regretted the absence on business of Mr. J. G. Clark, who desired to propose it. He said that in Mr. Winslow they had a President who had a combination of talents—viz., tact and diplomacy—allied with ability and energy. Mr. Winslow had given the Association a lead which the members had profitably followed.

Mr. WINSLOW, in reply, thanked the members for their kind vote, and also for their support during his term of office. He felt that, in spite of the hard work, the pleasure of the office increased as the session advanced, and he came to know the members. He believed the Association had a great future, and that its educational side was tending to bring out the young men of the industry.

Mr. LIBERTY then proposed that a letter of congratulation be sent to Mr. F. Cauldwell (late of the Gaslight and Coke Company), and a member of the Association, upon his recent appointment as chief of the Distribution Department of the Exeter Gas Company.

This was carried unanimously.

NEW AMERICAN GAS-TESTING APPARATUS.

The current number of the "Journal of the Society of Chemical Industry" contains abstracts of the specifications of three American patents relating to gas-testing apparatus.

Mr. H. C. Parker, of Holyoke (Mass.), has devised a process for analyzing gas. A stream of gas is forced, by means of a constant-flow pump, through the absorbing reagent, and the residual gas is sent into the atmosphere by means of a second pump driven synchronously with the first. The inlet to the former communicates also with the atmosphere through a small orifice, through which, consequently, air equal in volume to the absorbed gas is drawn. Means are provided for recording the drop in pressure between the atmospheric side and the inner side of the orifice, and thus a record of the volume of the in-drawn air—that is, of the absorbed gas—is obtained.

A patent for a test-burner has been granted to Mr. G. M. S. Tait, of Montclair (N.J.), as assignor to the Tate Producer Company, of New York. The burner is made entirely of heat-conducting material, and is in two parts, which fit together with a ground conical joint so as to grip a piece of wire gauze between them. The lower part of the burner is fitted to the gas-supply pipe, and the gas burns within the upper part of the burner. This part comprises a small chamber just above the gauze, and a vertical pipe leading the gas from this chamber to the top of a second dome-shaped chamber above the first. The outlet for the flame or combustion products is a large opening in the side of the dome-shaped chamber.

Mr. F. A. Stamps, of Niagara Falls (N.Y.), has devised a gas-calorimeter in which the gas is burnt so that the products pass up through a wide vertical metallic chimney having radiating ribs, and the calorific power of the gas is indicated by the expansion of the chimney. The multiplying and recording or indicating mechanism comprises a lever pivoted on the free upper end of the chimney, and bearing at one end, near the pivot, against a fulcrum carried by vertical compensating bars of the same metal as the chimney, but situated at a distance from it.

"Field's Analysis" for 1912.

We have received from the compiler, Mr. William Blakey, the Accountant to the Gaslight and Coke Company, a copy of "Field's Analysis," which has now reached its forty-fourth year of publication. The first part of the book is devoted to the accounts of the Metropolitan and Suburban Gas Companies; and the second to those of the English Provincial, Scotch, and Irish gas undertakings in the hands of corporations and companies. The next two pages of the book are usefully occupied by comparisons of some of the principal items in the analyses with those of preceding years—from 1908. Appended to the financial particulars are details of the coal carbonized, oil and spirit used, and gas made; the amount of capital employed per 1000 cubic feet of gas supplied on the days of maximum delivery; and the number of ordinary and prepayment consumers. The total number of gas consumers served by the three London Companies has risen from 1,178,517 to 1,223,995; those on the prepayment system being 807,206 on Dec. 31 last, compared with 768,753 at the close of 1911. The figures for the nine Suburban Gas Companies whose accounts are dealt with are: Ordinary, 145,974; prepayment, 222,653—total, 368,627. For 1911 they were respectively 141,538, 208,712, and 350,250.

Mr. Thomas Coates, the Managing-Director of the Whessoe Foundry Company, whose death was noted in the "JOURNAL" for the 15th ult., left estate of the gross value of £25,649.

TAR AND TAR PRODUCTS IN AMERICA.

By S. R. Church.

This was the subject of an address to the members of the Southern Gas Association on the occasion of their recent annual meeting at Charlotte (N.C.). The author confined himself to presenting to his audience some data, mostly unpublished, concerning tar as a raw material in the United States, and the products derived from it; and he mentioned some of the requirements which these have to meet. The following are extracts from the address.

The author introduced his subject by referring to the principal pioneers in the tar industry in America, and pointed out that they were not connected with any gas interests. He said the only encouragement the tar industry received from the gas companies in its early days lay in the fact that the latter were glad to have a market provided for their tar and ammoniacal liquor, practically all of which, until that time, had been disposed of without any return, and often at much expense and inconvenience.

Having offered some remarks on the place of tars in the field of bitumens, the author passed on to consider the

Production and Sources of Tar.

Until about twenty years ago, city and town gas-works constituted the entire source of the production of tar. In 1894, the first bye-product coke-oven plant was erected at Johnstown (Pa.) for the Cambria Steel Company. Bye-product coke-ovens had been in operation in Germany since 1881. At the present time, the bye-product coke-ovens supply about two-thirds of the total tar production of America. This production was estimated by Mr. R. P. Perry, in a communication to the Eighth International Congress of Applied Chemistry, as 165 million gallons for 1912. The rapidity with which the production of bye-product coke-oven tar is increasing, is indicated by the fact that, during the year ending in September, 1912, new coke-ovens began operation with a capacity of approximately 35 million gallons of tar per annum. If all the coke now made in beehive ovens were made in ovens of the bye-product recovery type, the additional production of tar per annum would be about 375 million gallons, as estimated by Mr. Perry, or, according to Mr. Parker,* 500 million gallons.

Until very recently, it seemed that the production of gas-works coal tar would be largely reduced by the growing popularity of installations for making water gas. The present production of water-gas tar is impossible to estimate, as a great deal of it is burnt by the companies producing it; but it may be about 50 million gallons. The success in England of vertical retorts for making coal gas, and of recent installations of this type of retort in the United States, indicates the possibility that this development, together with the increased cost of gas oils from petroleum, will cause the production of water gas to remain stationary, or possibly to decrease.

Character of Crude Tars.

Mr. Perry, in the communication already referred to, says:

Depending upon the coal used, and more particularly upon the size and shape of the retorts, the travel which the gases make over the hot surfaces, and the temperatures to which the gas is subjected, the coal tars vary within wide limits. In general, with the vapours subjected to the higher temperatures usually characteristic of gas-works as compared with coke-works, there is an increase in specific gravity and free carbon. For example, the tar from many gas-works will average about 1·24 sp. gr. at 15·5° C. (60° Fahr.) and about 25 to 30 per cent. free carbon by weight; whereas from the bye-product coke-ovens the specific gravity would average more nearly 1·19, and the free carbon would vary from about 5 to 18 per cent.—the average being less than 10 per cent.

The writer believes that the coal used has less to do with the character of the resulting tar than the heat and other factors mentioned. Mr. Lewis T. Wright made experiments some twenty-five years ago, and from one coal, carbonized at temperatures from 600° C. to 800° C., he obtained tars varying from 1·086 to 1·206 specific gravity, containing from 29 to 64 per cent. of pitch residue.† The late Dr. H. W. Jayne, in a paper submitted to the Fifth International Congress of Applied Chemistry at Berlin, in 1903, said:

The influence of the temperature used in carbonizing is strikingly shown by the test of two tars, both from the same coal, and made in the same kind of ovens. One plant was producing gas as its main object. The tar from this plant had a specific gravity of 1·21, and tested 17·5 per cent of carbon; the light oil fraction was 2·2 per cent., of sp. gr. ·979, testing 23 per cent. to 170°. The total acids in the tar oils were 3·6 per cent.; and the dry pressed naphthalene 7·4 per cent. In the second tar, in which coke was the main object, evidently much lower heats were used; the tar having a specific gravity of 1·137, and testing 3·2 per cent. of carbon; the light oil amounted to 11·9 per cent., and had a gravity of ·970, testing 28 per cent. to 170°, or six times more crude naphtha than in the first tar. The total tar acids were 12·48 per cent., while the pressed naphthalene fell to 1·2 per cent. It is evident that in the first tar the light hydrocarbons and tar acids have been destroyed by the temperature employed, with formation of naphthalene.

* "Mineral Resources of the United States in 1910." Bulletin of the United States Geological Survey.

† See "Journal of the Society of Chemical Industry" for 1888 (p. 59).

From a series of analyses made a few years ago at one of our laboratories, and from more recent analyses made in the writer's own laboratory, the following are selected as typical of the tars produced in the United States (all tests on dry tars):

	Gas-Retort Tar.			Coke-Oven Tar.			Water-Gas Tar.
	Horizontal.	Inclined.	Vertical.	United Otto.	Semet-Solvay.	Koppers.	Eastern.
Specific gravity at 15·5° C.	1·266	1·238	1·153	1·207	1 188	1·186	1 083
Free carbon (insoluble in C_6H_6)	28·9	24·3	..	13·3	10·7	6·8	0·1
Spec. viscosity (Engler at 100° C.)	21·8	14·9	2 1	3·4	3 0	2·1	1·6
Oil to soft pitch, 60° C., m. p. (per cent. by volume)	13·2	14 3	28 8	21 2	21·8	35·3	43·1
Pitch residue, 60° C., m. p. (per cent. by volume)	86·8	85·7	71·2	78·8	78·2	64·7	56·9
Refractive indices at 60° C. (taken on oil)	1·5932	1 5807	1·575	1·5987	1·6122	1·6139	1·5678
Sulphonation residue (per cent. taken on oil)	0·4	2·4	4·3	..	..	..	8·0
Tar acids (per cent. taken on oil)	14·0	21·0	29·0	12·0	4·0	..	..

Hubbard has published in very concise form, in Circular No. 97 ("Coke-Oven Tars"), of the United States Office of Public Roads, analyses of practically all of the coke-oven tars now produced in America, including estimates of the maximum temperatures attained in their production. It is from these raw materials of varied physical and chemical characteristics that we have to derive marketable products. While some of these products—such as carbolic acid and its homologues, benzol and its homologues, naphthalene, pyridine, &c.—are definite chemical compounds, and hence are the same, no matter from what kind of tar they are derived, by far the greatest portion of the tar is worked-up into cruder products obtained by fractional distillation as distillates or residual products, and varying in composition according to the variation of the crude tars from which they are produced. Therefore, in considering the value of any given tar, it is necessary to determine not only what it will yield in the definite chemical products mentioned, but what will be the value of the other products, more important from the tar distillers' standpoint—viz., creosote oil and pitch.

Products of Tar Distillation.

I will not attempt even to enumerate the products that can be obtained from coal tar, but will confine myself to a brief consideration of the principal products that are at present produced in America by tar distillers, including an attempt to show what the requirements for the principal products are, the relation existing between these requirements, and the characteristics of the original tars with which we have to deal.

Crude Tar.

The proper uses of crude tar are very limited. Perhaps the largest uses have been for coating iron pipe and for road surfaces. Some crude tars, the content of water and free carbon of which is not excessive, have been satisfactory for pipe coating; while other crude tars have proved unsatisfactory. For road treatment, the use of crude tar is undoubtedly bad practice in most cases; and the failures of roads treated with crude tar or improperly selected refined tar have made it harder to promote the use of tar products for road treatment. Hubbard, in his "Dust Prevention and Road Binders," says that it is not even economy to attempt the application of crude tars "when not sufficiently liquid to apply cold;" and, of course, few crude tars, except water-gas tar, could be applied cold. Crude water-gas tar is not suited for any sort of road treatment, except possibly as a temporary dust layer.

Dehydration.

Before anything can be done with tar, it is necessary to get some of the water out of it. The gas-works manager may not be a chemist, and may have only a very indefinite idea of the wonderful products contained in his tar; but he is likely to have a very lively and definite knowledge of the fact that it contains water in varying quantities, and that it is impossible to divorce these highly incompatible substances. Heating in storage-tanks slowly separates a part of the water by gravity. From an examination of records covering a period of eight or ten years, I estimate that the reasonable percentage of water left in the tar by the gas-works should not exceed 7 or 8 per cent., unless a tar unusually high in free carbon is encountered. Such tars frequently carry from 20 to 30 per cent. of water, and hate to give it up. Removing the water by distillation is, of course, effective. But it is expensive, and will soon be considered bad practice, if it

is not already. The most recent method of dehydration introduced by the tar distillers, after much rather costly experimental work, is based on the conclusion that water, having a specific heat of two-and-a-half to three times that of tar, and increasing in volume 1600 times when converted into steam, should therefore be driven out by heating a thin film of tar, and not by boiling in a still, where the liquid may have a depth of 5 to 8 feet.

Light Oil Products.

The first fraction from the distillation of coal tar has a gravity lighter than water. It constitutes the source of most of the highly refined substances already referred to as definite chemical substances. An analysis of 26 tars, of which about half were coke-oven and half gas-retort tars, yielded an average of 2·4 per cent. of light oil, varying from 0 to 4 per cent. In working-up this light oil, approximately 40 per cent. yield of benzol, toluol, and heavier solvents is obtained, averaging about 1 per cent. of the tar; the variation in the yield of benzol and solvents being from 0 to 2 per cent. of the tar.

The production of pure benzol and kindred products requires an expensive installation. The process includes re-distillation of the crude light oil, treatment with sulphuric acid and alkali to remove impurities, and steam distillation in column stills to separate the various fractions and finally secure pure products of constant boiling-point. These processes, although comparatively simple from a chemical standpoint, require very close laboratory control, and great care must be exercised to keep the products free from contamination.

Benzol and the kindred coal tar solvents are used in many industries, and have to meet rigid requirements as to purity. The different grades of benzols made at one refinery are: Pure benzol boils at 80° to 82° C.; 100 per cent. benzol, at 100° C.; 90 per cent. benzol, at 100° C.; 50 per cent. benzol, at 100° C.; pure toluol, at 110° to 112° C.; pure xylol, at 135° to 145° C.; solvent naphtha, 90 per cent. at 160° C.; heavy naphtha, 85 per cent. at 200° C.

Carbolic acid is another refined product which is derived directly from coal tar light oil, and which in its manufacture requires exceedingly careful manipulation, involving a number of re-distillations, the final one usually under vacuum.

Naphthalene is another pure product obtained from the light and middle oil fractions. The crude naphthalene, after removal from the oil by freezing, filtering, or passing through centrifugal machines, or by a combination of these processes, is re-distilled, chemically washed, and crystallized or sublimed. It is produced in various forms, such as flakes, balls, &c.

Creosote Oil.

The successful working-up of coal tar must necessarily include the production of a marketable grade of creosote oil, which can be disposed of to good advantage. As the requirements for this product have been very much more closely defined of late than in former years, it may be well to devote considerable attention to this subject. Creosote oil formerly included the entire distillate after the small light oil fraction has been removed, until the end of the distillation. In American practice, it is general to carry the distillation to a point where the pitch is of the proper consistency, controlling the distillation by tests of the pitch. This will be explained later in describing pitch. While the character of the creosote oil depends largely on the tar from which it is derived, its distillation range is, of course, very largely dependent upon the hardness of pitch made. The average pitch made is of roofing grade.

The average distillation test of creosote oils from making soft pitch is 18 per cent. distillation at 210° C., and 57 per cent. at 235° C. In making hard pitch, the average test of the oils is 11 per cent. at 210°, and 43 per cent. at 235°. Now, the controlling requirements in practically all specifications for creosote oil, for whatever purpose, are two—first, the origin of the oil; second, its distillation range. Many other requirements are included; but though their presence in the specifications causes the producer a lot of extra work and worry, these other tests are usually intended to be in accordance with the characteristics of an oil having a certain distillation test.

Though a few years ago most of the creosote oil made was sold "as is," there is very little sold to-day except under specifications, which are often very rigidly (sometimes unreasonably) drawn. I have recently compiled and indexed the creosote oil specifications under which we are now disposing of our product. There are 138 of them; 114 require specifically that the oil shall be a pure product of coal tar; 15 have no definite requirement as to origin; 8 permit an admixture of oil from water-gas tar, and 1 specifies a water-gas tar product. An average of these specifications (omitting all specifications for oil for treating paving blocks, which generally contains tar) shows that the average distillation limits are only 7·2 per cent. at 210°, and 33·7 per cent. at 235°. There is not one specification in the lot that would permit the use of the average oil made by including the entire fraction from light oil to soft pitch, and very few that would pass the average oil made in running hard pitch. This means that in distilling tar, instead of including everything above light oil in the creosote oil fraction, a fraction known as "middle oil" has to be separated. The size of this fraction has to be determined by knowledge of the tar used and the creosote specifications to be met, and requires close laboratory control. The "middle oil" fraction is usually high in tar acids (crude cresylic and higher phenoloid bodies) and naphthalene. This oil, without subsequent treatment, has very little value, and must either be sold at a very low price for creosoting, or else burnt.

Refined Tar and Pitch.

I have stated that the distillation is continued until the residue has the proper consistency. Of late, the residual products—whether soft pitches for road construction, paving filler, &c., or medium pitches for roofing or waterproofing, or harder pitches for briquetting, &c.—often have to meet various more or less stringent specifications, just as the creosote oil does.

Taking the more common residual products in the order of hardness, we have refined tar or soft pitch for saturating roofing felt. This tarred felt is one of the principal products of the tar industry. To make a tarred felt that is uniformly satisfactory requires constant attention to the character of the saturating material. This must be held within very definite limits as to its viscosity and percentage of insoluble material, while the temperature of the bath and the speed of the machine and other controlling factors have to be regulated, so as to provide sufficient saturation and to avoid over-saturation. I have found very few tars from which, by themselves, a very good saturating material can be produced. It is generally necessary to combine two or more tars to secure the most desirable product.

Refined tar for road surfacing varies from a thin product that can be applied cold, to a pitch having a melting-point of over 100° Fahr. In the production of road tars, the distiller is again confronted with the situation of having to meet innumerable specifications. Some of these are reasonable, and often the manufacturer is consulted in regard to what he can furnish; but very often this is not the case. There exists considerable difference of opinion as to the characteristics desired in refined tars for road work. Taking the one feature of free carbon content, we have to meet specifications all the way from one requiring that the free carbon shall not exceed 10 per cent., to another requiring that it shall be between 30 and 35 per cent. Contrary to the testing of creosote oil, for which a standard test has been almost universally adopted, there are many different methods of testing road tars; and too often the specifications do not clearly indicate what method is to be followed.

At present, manufacturers of bituminous road materials—and this applies to asphalt and petroleum products as well as tars—often find it difficult to meet the various specifications which are adopted by cities, counties, and states, and at the same time produce materials that meet their own ideas as to quality. A road is constructed, using as a binder a material for which the specification may not have been approved by the manufacturer. Later on, if the road fails, the binder is usually blamed. If it is a tar binder, it makes no difference what kind of tar it was, all tar binders will receive a set-back in that locality for some time. Producers of tar who have not studied this subject, and learned by experience what should and what should not be used, can do the industry a great deal of harm by allowing tar to be employed indiscriminately in road construction.

More pitch is used for roofing and waterproofing than for any other purpose. A very high standard has been set for "straight-run coal-tar pitch" for built-up roofs; and the success of this type of roofing can justly be credited to the tar distillers. In the production of roofing pitch, as in the production of the saturating material that enters into the tarred felt, it becomes necessary to select tars with great care. Often tar of a special character has to be transported to some distant point in order to make a satisfactory combination for the production of high-grade roofing pitch, even though a surplus of tar of another grade may exist at that particular point.

The production of hard pitch has been relatively much less in the United States than in Europe, because for many years the industry of fuel briquetting has flourished there, and has formed the principal market for pitch. This has enabled the foreign tar distiller to more readily produce creosote oil of the desired high boiling character. A larger market for hard pitch in America is sought for, and many uses have already been developed, though coal briquetting progresses but slowly. For the production of hard pitch, the average gas-works tar contains more free carbon than is desirable, both from the standpoint of wear and tear on the stills and quality of the product. A moderately high percentage of free carbon is desired in soft pitches; but this is usually not true of pitches harder than the roofing grade.

In conclusion, I suppose that some attempt should be made to answer the question that must be uppermost in your minds: What should a gas-works do with its own tar? However, I will not attempt to answer this question. Mr. Whittaker, in his paper on "Tar and Tar Products" read before the American Gas Institute in 1911,* has given you a description of an attempt on the part of one gas company to work up their own products. I can only urge that if you do this you work for the general good of the industry, and do not attempt to sell products that are not really suitable for the particular purpose. It seems to me that a chaotic condition would result if there were not large refineries of tar, independent of the gas-works, which are willing and able to absorb the tar from the various sections of the country whenever a large new supply is developed. Therefore, to some extent, those of you who engage in tar distillation would seem to be under obligations to the large distillers.

* The paper here referred to was noticed in the "Journal" for Dec. 26 1911 (p. 921).—Ed. J.G.L.

THE COKING OF COAL AT LOW TEMPERATURES.

AN OXYGEN-FREE ATMOSPHERE ESSENTIAL FOR THE BEST RESULTS.

By S. W. Parr, Professor of Applied Chemistry, and H. L. Olin, Research Fellow at the University of Illinois.

Last week, pp. 533-5, some portions were given (from the "Scientific American Supplement" for the 19th ult.) of the report of the researches made by Messrs. Parr and Olin as published in Bulletin No. 60 of the Engineering Experiment Station of the University of Illinois. The rest of the report appears below.

V.—Coke.

Yield of Coke.—The yield of coke, under average conditions, as already noted [in tables given last week], is approximately 75 to 80 per cent. This factor will, of course, vary greatly with the amount of ash originally in the coal, and with the temperature at which the distillation has been carried on. These items of variation are shown in the following table where material of widely varying composition was used.

Table VII.—*Composition of Coke Residues.*

—	Experiment No. 11, Vermilion County.	Experiment No. 13, Franklin County.	Experiment No. 14, Saline County.
Moisture	0·34	0·40	0·28
Ash	11·15	9·28	6·97
Volatile matter	27·61	26·60	23·50
Fixed carbon	59·90	63·72	69·23
Sulphur	2·58	1·21	1·20
B.Th.U.	12,892·00	13,446·00	13,746·00

Table VIII.—*Showing the Yield of Coke from Various Coals referred to Original Coal—Dry Basis.*

—	Experiment No. 11.	Experiment No. 13.	Experiment No. 14.
Ash	9·56	7·92	6·04
Volatile matter expelled	25·48	18·00	19·12
Residual coke	78·10	84·72	84·86

Oxygen Removed.—Decompositions occurring at temperatures in the neighbourhood of 400° C. include the liberation of oxygen, or, as it is frequently designated, the water of constitution. Since this ingredient of the raw coal is non-combustible, it has the same function as so much ash. Its removal, therefore, serves to make of the resulting material a richer or more concentrated fuel. This feature is still further promoted by the removal of the hygroscopic or free moisture which usually exceeds in amount the water of constitution. This point may be illustrated by the accompanying table, wherein the heat values per pound of the original coal are compared with the heat values per pound of the residual coke. There is also given an estimate of the amount of non-combustible material removed in the form of water in the process of decomposition.

Table IX.

Samples.	B.Th.U. per lb. as Received.	B.Th.U. after Treatment. Per lb.	Gain Thermal Units.	Gain per Cent.	Estimated Loss of Total Non-combustible Free and Combined Moisture.
Williamson County	12,695	13,150	455	3·60	10·30
Saline County	13,583	13,746	163	1·63	8·93
Vermilion County	12,673	12,892	219	1·72	13·30

Properties, Porosity, Hardness, &c.—The coke material obtained by this process varies in character somewhat with the kind of coal used, and also the amount of pressure employed during the carbonization. The Williamson County coal, for example, gives a coke of much finer texture and less porosity than the coal from Vermilion County. With a view to determining the reason for this greater porosity or to finding the conditions that would modify it, the attempt was made to carry on a test with the coal sample under pressure. To this end, the following apparatus was used.

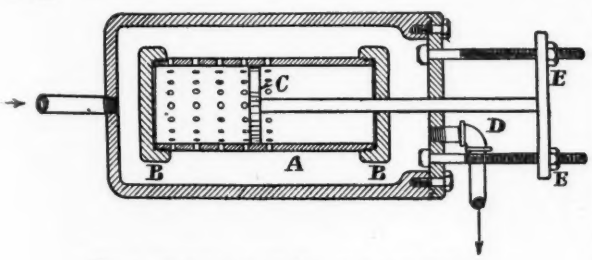


Fig. 3.—Container for Coking Coal under Pressure.

Apparatus.—A (see fig. 3) is an iron cylinder, 8 in. by 4 in., fitted with two screw caps B, which received the coal. The movable piston C, to which is attached a long rod D, is pressed against the charge by tightening the nuts E. The cylinder is perforated with small holes to allow the escape of gases. This contrivance was fitted into the retort originally employed, and heat was applied as before.

Exhibit 1 shows the results obtained when pressure is applied slowly during the entire heating period. The outer portions passing through the temporary state of fusion soon harden and form a wall which resists external pressure. The inner core, therefore, is extremely porous. When sufficient pressure is applied, the outer part fractures, and (as in this case) the residue comes out broken up into small pieces. The coke shown in the figure is from coal from Perry County. The specific gravity of the outer portions of the mass is 0·733, against 0·652 when coked without pressure.

It was evident, therefore, that in order to get a firm block, pressure must be constant. In the next run, the charge was rammed into the cylinder and the piston was screwed-up tightly, but not moved after heating had begun. The resulting column cohered well and showed the same increase in specific gravity as the one mentioned above.

Illustrations of Various Products.—An interesting feature of the product is the complete fusion of the mass, where proper conditions exist—*i.e.*, the individual particles of coal of buckwheat or pea size have completely lost their identity, the resulting homogeneous mass showing no lines of demarcation from the original pieces of coal. The texture, however, in some cases is finer or closer than in others. These points are well illustrated in photographs of typical masses, as reproduced in Exhibits 2 and 3, for coals from Southern Illinois. Exhibit 4 represents a somewhat coarser texture. It was made from Vermilion County coal. For the composition of these samples, reference is made to Table VII. [Exhibits 1 to 4 are here referred to.] Exhibit 2 from Saline County coal showed a crushing strength of 750 lbs. per square inch;* and Exhibit 3 from a Franklin County sample crushed at 900 lbs. On account of its coarse cellular structure, Exhibit 4 showed little rigidity, and broke down at a pressure of 300 lbs.

Résumé Relating to the Coke Product.—It is evident upon examination of the coke product obtained, as above described, that we have here a fuel of firm texture, not readily broken down by handling, and producible in the most convenient sizes for handling and for efficiency in combustion. It is, moreover, in a more concentrated form, in that, for the most part, the free moisture and the water of constitution have both been removed. Thus, in freshly-mined coal there would be eliminated from 15 to 20 per cent. of inactive material. Again, the heavy hydrocarbons have been removed. These are the constituents most directly responsible for the formation of smoke in the combustion of untreated coal. It is to be noted further that because this coke has been subjected to a temperature just approaching a red heat, it will not begin to evolve volatile matter, when thrown on the fire, before it again comes up to or passes that temperature.

The effect of this point is twofold: First, there is obviated the cooling effect which must be necessary in the vaporization of moisture in the raw coal which also lowers the temperature just when a high temperature is needed for burning the heavy hydrocarbons; and, second, the remaining gases to be evolved consist almost wholly of ethane or marsh gas (CH_4) and hydrogen, both of which are readily combustible. The hydrogen, of course, will burn with a non-luminous flame, and is incapable of making any smoke. The marsh gas (CH_4), though it has carbon in its composition, adds but little luminosity to the flame, and is almost incapable of producing smoke in the process of combustion.

It may be well to analyze briefly the processes of combustion as they occur in an ordinary hand-fired furnace. The first result of throwing a mass of coal upon a fire is to lower the temperature during the time of volatilization of the moisture in the coal. Theoretically, the temperature of the mass during this process would remain at, or slightly below, 100° C.

Other factors tending to lower the temperature would be the specific heat of the coal and the heat necessary to effect the decomposition, since it is probable that the decomposition reactions are endothermic up to approximately 300° C.

It is to be noted that during this depression of the general temperature there are being distilled from the coal such volatile substances as are liberated at these lower temperatures. This point can best be illustrated by means of the accompanying diagram. In fig. 4, the region between the lines A and B may be assumed

* John Fulton (Coke, p. 334) gives 1200 lbs. per sq. in. as the ultimate crushing strength of standard Connellsville coke. Bye-product coke is, in general, considerably stronger. The crushing strength is important in reference to the load or burden the coke can withstand in the furnace without crushing.

to include those volatile constituents that are driven off at a temperature below 400° C. This area includes the free moisture of the coal, the combined moisture or water of constitution, or (as some prefer) the oxygen compounds of the coal, shown on the chart as inert volatile; and, in addition, some of the pure hydrocarbons which constitute a portion of the true volatile combustible matter. It is, moreover, the nature of this latter or volatile combustible material with which we are just now concerned in this discussion of the processes of combustion. It is to be noted first

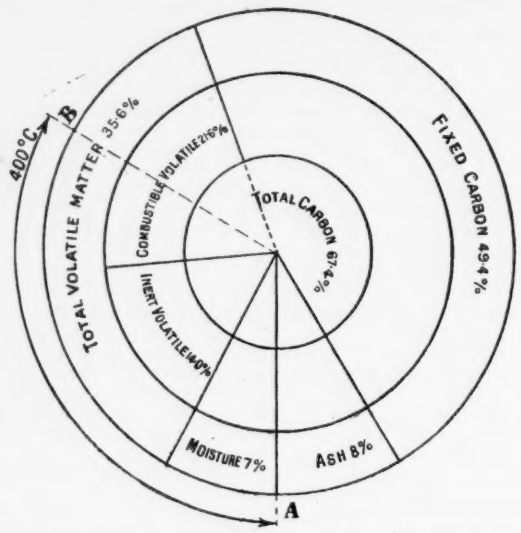


Fig. 4.—Diagram showing the Constituents Driven Off Below 400° C.

that this volatile matter contains the bulk of the heavy hydrocarbons. By this is meant that they belong to the higher series of any of the homologous compounds present, which in general are characterized by a higher percentage of carbon. For example, if the series is that of marsh gas or methane CH_4—*i.e.*, C_nH_{2n+2}—then the next higher order of this series would be ethane, or C_2H_6, and the next propane, or C_3H_8—the carbon percentages respectively being 75, 80, 81·8, &c. Again, a very considerable part of the volatile matter delivered at this temperature belongs to the methylene series (C_nH_{2n}); and the first known member of the series is ethylene or olefiant gas (C_2H_4), with a carbon percentage of 92·92. Moreover, this last compound may be made to break down under higher heat into members of other series—as acetylene (C_4H_4), benzene (C_6H_6), and naphthalene ($C_{10}H_8$). Other members of the ethylene or paraffin series are found which ally the resulting complex mixture quite closely to the very complicated compounds with which we are familiar in petroleum.

The point to be noted in this phase of the discussion is the fact that compounds discharged at this relatively low temperature, and having these high percentages of carbon, are the most difficult of complete combustion without the formation of smoke.

It is not necessary to discuss the mechanics of the combustion of hydrocarbons. As a result of the researches of Professor H. B. Dixon and of Professor Bone, the selective theory of oxygen for hydrogen, or the dogma of "preferential combustion of hydrogen," has been obliged to give place to the theory of the intermediate formation of "oxygenated" or "hydroxylated" molecules. In any event, or whatever the theory finally developed by Professor Bone in his most important researches on combustion, the fact remains that these heavier hydrocarbons are the most difficult of all with which to effect complete combustion, and that, even under favourable circumstances, the tendency in their combustion is to form condensation products in which free carbon largely predominates. The faulty reaction is thereby made visible to the eye as smoke. A good illustration of this fact is found in acetylene gas, which requires a special burner, with special provision for extra oxygen supply, in order to produce a smokeless flame.

Smokeless combustion of raw coal is secured, therefore, by observing the principles indicated above—*i.e.*, there must be uniform and gradual accession of fresh coal, and a combustion chamber maintained at a sufficiently high temperature, and the same extending over a sufficient space to permit of ultimate mixing and contact of the oxygen with the combustible gases. Other conditions—such as accelerating the reaction by introducing the principle of surface combustion, as developed by Professor Bone—may at some time be added to the mechanical and physical conditions now in vogue. But while these provisions are readily adapted to large steam-generating units, they are impossible of application to the larger members of combustion processes such as are common to the small plant, house heaters, and possibly to locomotives. It is these latter cases especially that demand a modified fuel which can be burned without the formation of smoke.

It will thus be seen that in the low-temperature distillation of coal, processes have been put into operation which have taken out the heavy smoke-producing ingredients, and have also removed the moisture, both free and combined, which are chiefly responsible for the depression of temperatures under ordinary conditions. There is left, moreover, as volatile matter, practically these volatile substances only—methane (CH_4) and hydrogen, which, most easily of all the gaseous products from coal, maintains a smokeless combustion.

VI.—The Formation of Coke.

The experiments as thus far conducted seem to throw some light upon the matter of coke formation. In this discussion of the theories involved, it may be helpful to formulate certain hypothetical conditions which have had more or less confirmation in these studies, as follows: First: For the formation of coke there must be present certain bodies which have a rather definite melting point. Second: The temperature at which decomposition takes place must be above the melting point. Third: Where the compounds that satisfy the first and second conditions are unsaturated, it is possible, by subjecting them to oxidation, so to lower the temperature of decomposition as to alter the second condition prescribed, in which case coking will not occur.

Discussion of Conditions.—The first condition prescribed above may be well illustrated by the behaviour of sucrose or cane sugar.

Diagram 1.

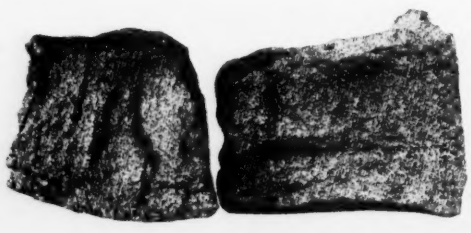


Diagram 2.

Diagram 3.

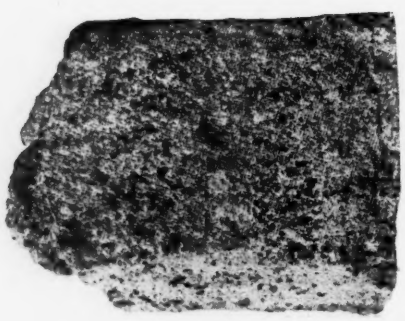


Diagram 4.

Diagram 5.

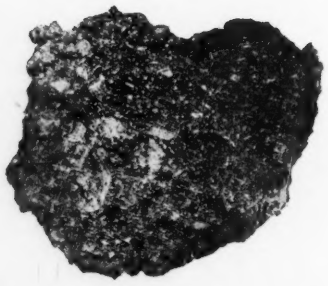


Diagram 6.

This substance has a rather low melting-point—say, 160° C. This melting-point, however, is just below the temperature of decomposition. Where this point is reached, gaseous products in the form of steam, &c., are delivered, leaving behind, if the temperature is continued, a mass of coke. On the other hand, if starch is heated in a similar manner, it does not melt, but its first action is that of decomposition. When this is carried to completion, there remains not a strongly coherent mass, but easily disintegrated particles of carbon. Pure cellulose behaves in a still more striking manner, showing no fusion properties whatever—as may be demonstrated by distilling in a closed tube some cotton fibre, or other form of cellulose, such as filter paper beaten to a pulp and dried. Wood, however, if not disintegrated, as in the form of sawdust, has enough resinous material closely associated with the fibrous structure to bind the carbon filaments resulting from the decomposition of the cellulose, by reason of the fact that

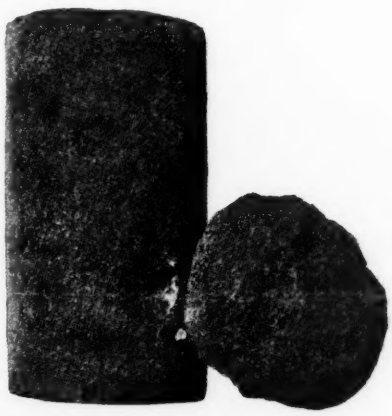


Diagram 7.

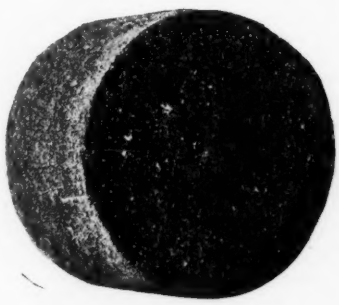


Diagram 8.

Diagram 9.

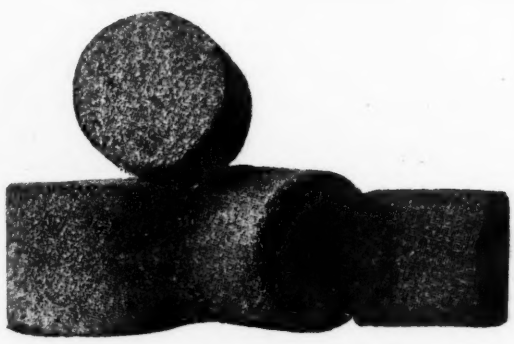


Diagram 10.

these gums, or resins, have a melting-point below that of their decomposition temperatures, and thus form a binding film of carbon throughout the mass, producing a sort of coking effect which we find in charcoal.

In the case of Illinois coals, we find the first pre-requisite formulated above present in a marked degree. As an illustration of the fact of a low melting point, reference is made to Exhibit 5, which is a photograph of a mass of such material, which exuded from a sample of Vermilion County coal, that had been subjected to the treatment already described. The lump shown is part of a mass that flowed out of the container, forming a bubble-like puddle. It would seem, therefore, that this type of coal from the North Danville field (electric mine) has the first essential for coke formation in a marked degree.

As illustrating the conditions which exist where oxidation had been allowed to take place, an example is given in Exhibit 6. This was made from a weathered sample of coal from Niantic. It had little, if any, tendency to fuse. The individual particles of coal still retain their form, and the mass may be easily crumbled between the fingers. It should be noted that this result is not due to any inherent quality possessed by the original coal—a Danville mine sample, for instance, weathered to a like degree, gives the same results.

Test No. 9.—Another verification of this point, though in a more marked manner, was the result of test No. 9. The coal used was the fine material which had collected from the preparation of the previous tests, all of which had given excellent samples of coke in their freshly prepared condition. A quantity of coal passing through a 10-mesh sieve had accumulated through a period of about six weeks, and had been stored in an ordinary coal-hod in the grinding-room. After being heated for eleven hours under conditions identical with those of the preceding runs, it showed no signs of fusion, and was entirely without coking properties.

It is evident from these tests that the very great avidity of fresh coal for oxygen is evidence of the presence of those compounds which satisfy the first of the hypothetical conditions given above, and the subjection of the coal to oxidation destroys the fusion property of the fresh coal and produces a condition corresponding to that described under the third proposition in which the coking property is lost.

Other studies on the nature of the coking process were carried out as follows: The apparent plasticity exhibited by the coal during certain stages of the treatment suggested the idea of compressing it into a briquette at the time when it would most easily yield to pressure, and when it would presumably cohere without requiring an artificial binder. Accordingly, a cupel press with a pressure of 500 lbs. was provided, and the retort was charged with Danville mine coal. At the time of maximum evolution of gas, the heat was suddenly shut off and the retort quickly opened. It was found at this point that the outer and hotter portion of the mass was hard and unyielding. A soft inner core was discovered, however, and the portions of this were put into the press. The resulting briquette is shown in Exhibit 8. The escaping gases have swollen it considerably. Determinations of the amount of volatile matter possessed by the coal when in the plastic condition showed that this constituent had been reduced very little—from 38 to 30 per cent. In short, the state of fusion seems to exist in early stages of distillation, but disappears before the process has proceeded far.

In one of the earlier tests with Danville mine coal, using the apparatus described in fig. 3, the extreme fusibility of this type was again demonstrated. As the piston was slowly forced in, pencils of bituminous matter were squeezed out through the holes of the cylinder. Exhibit 5 includes some of these nodules. The fact that there was a selective separation of bitumen is proved by a comparison of the ash values, the residue as a whole having 13 per cent., and the nodules 8 per cent., of ash.

The readiness with which the cementing material ran to waste seemed to indicate that the coal contained a superfluous amount of it—more than was necessary for binding itself together. The correctness of this view was shown by a series of runs, in which crushed gas house coke and anthracite were heated with varying amounts of bituminous coal.

Exhibit 7 shows the hard firm product resulting from the mixture of equal parts of Majestic bituminous coal and gas house coke, both crushed to 20 mesh. Fairly good results were obtained in the next run with 75 per cent. of the coke and only 25 per cent. of Danville electric coal. In like manner, powdered anthracite and bituminous coal in ratios varying from 1 : 1 to 3 : 1 were firmly cemented together. Pitchy material no longer exuded from the retort; being absorbed, seemingly, by the added substance.

One of the essential factors in this scheme for briquetting loose infusible material with bituminous coal is the use of the press for keeping the two substances in close contact. On account of the difficulty of applying such a contrivance in industrial work, attempts were made to attain the desired end by using temporary binders—*i.e.*, substances which might hold the particles together closely until the permanent coal binder could relieve them.

Mixtures of Danville mine coal and Danville mine coke residue No. 17, in the proportion of 3 : 1, were thoroughly moistened with water, and pressed (1) in the cupel machine and (2) in a testing machine up to 1000 lbs. per square inch. Neither of the briquettes survived the subsequent heating—being disintegrated, seemingly, by the escaping steam. The same effect, though to a much less degree, was noted when coal tar was employed. The resulting briquette retained its shape, but was rather soft and friable. Crude molasses, of all the binding materials tried, proved to be the best for this purpose. Different percentages of the molasses, ranging from 5 to 15, were tested out at different times. Below 10 per cent. the strength of the briquette was much diminished. Exhibit 9 is a 3 : 1 mixture of Danville mine coke residue and fresh Danville mine coal, both ground to 20 mesh, first bound with 11 per cent. of molasses, and then pressed in the cupel machine. The cake was next heated in the retort under the atmospheric conditions of all preceding runs. This briquette, 2 inches high and 2 inches in diameter, has a crushing strength of 550 lbs. per square inch. Exhibit 10 shows anthracite briquettes made in the same way. They have a specific gravity of 1·02, and crush at 650 lbs. per square inch.

These tests seem to show that the fusible substance of Illinois coals is the true binding material in the coking process—that it is present in such abundance as to produce a coke of too open and

spongy a character, as a result of the evolution of the large amount of gaseous products which result from its decomposition. In this respect it is paralleled by the behaviour of sugar in the process of coking, which yields, as a result of the large volume of escaping gases, a very porous mass of sugar-coke or carbon. However, if the raw coal is mixed with a considerable amount of material which has already gone through the coking process, or which has at least given off the larger part of its gases, and then has been reduced to a fine division like breeze, the cementing material of the fresh coal is able to disseminate through the mass; and the gases may also escape without blowing it into a spongy mass, with the result that a coke of good texture is formed. Exactly in a similar way, if molasses or other sucrose or glucose material be substituted for the fresh coal, we shall again have the formation of a dense coke capable of retaining its shape under conditions of firing much better than where a plastic binder is used. In both cases a strongly cohering mass is produced which meets the requirements of handling, storage, and combustion with the greatest efficiency and the least formation of smoke. A small admixture of raw coal may thus be made to serve the purpose of a binder for material otherwise wasted as coke breeze, at a cost which would enable it to compete with the pitch binders now in use. It also suggests a process of fractional coking, or coking in two stages. The first result at the lower temperature furnishes a product which, when ground to a moderate degree of fineness and mixed with a small portion of fresh raw coal, would furnish the essential conditions for producing a coke of dense nature with a binder so distributed as to give the material a strength quite comparable with that produced by coals of the regular coking variety. Moreover, an advantage would be evident in such material, especially for use in household appliances, in that it would be more lively in combustion, and less difficult of manipulation in the matter of maintaining a fire, than coke made by the usual methods.

One point further is to be noted in this connection. It was said at the beginning of the discussion that superheated steam was employed for the purpose of conveying heat into the material, so that it would not be necessary to revolve the apparatus in order to secure an even distribution of heat. It is seen from the above details of the essential conditions to be observed in the coking of coals, at least of this class, that an atmosphere free from oxygen is of prime importance. Indeed, following the indicated requirement, the coal should be fresh, or as recently mined as possible, and in any event retained in larger sizes than in a broken-down or a fine state of division, in order that the least possible opportunity be given for the absorption of any oxygen. Furthermore, by first admitting steam or bringing the coal into an atmosphere of superheated steam, the effect is to drive out such oxygen as has been occluded or absorbed by the coal and as yet not chemically combined. This is also brought about at temperatures and under conditions least conducive to a reaction between oxygen and the coal substance. Moreover, from former experiments it has been shown that no reaction at these temperatures takes place between the steam itself and the coal. These principles have an important bearing on certain recent tendencies to concentrate gas production and coke manufacture in large units and distribute the gaseous products at high pressure. From the above, it would seem that the nearer such units were located to the mine or pit mouth, the better. If it is found (as seems probable) that the coke residue is a suitable material for further continuation of the gas-making process for the manufacture of producer gas, then the above advantages and essential conditions would be magnified.

Summary and Conclusions.

1.—Coals of the Illinois type can be coked at a temperature approximately 400° or 450° C.

2.—The gaseous products consist chiefly of illuminants of high candle power, and represent, together with the condensible material under (3) following, the chief elements involved in the formation of smoke in the ordinary combustion of raw coal. The nitrogen of the coal is liberated as NH_3, at these temperatures, in amounts representing approximately 20 per cent. of the nitrogen present.

3.—The condensable distillate consists largely of oils, with the minimum amount of tar and free carbon. The oils represent positive values for fuel, for carburetting water gas, or for other specific uses on account of their chemical characteristics as unsaturated compounds.

4.—The coke residue has special characteristics which seem to make it of value as a concentrated fuel, capable of combustion without the formation of smoke, suitable for storing without the possibility of spontaneous combustion, and presumably adapted to the manufacture of gas for use in suction-gas producers.

5.—Certain facts seem to have been developed concerning the principles involved in the formation of coke which may open the way to the production of a kind of coke of such texture and strength as to make it acceptable for uses that are not now possible with coke made from similar coal, but formed under ordinary conditions, such as are found in the ordinary gas-house retort practice, or that of the bye-product coke-oven.

DETERMINATION OF SULPHUR IN ILLUMINATING GAS.

By R. S. M'Bride and E. R. Weaver, of Washington.

Concluding this week our extracts from the report by the above-named authors to the Director of the United States Bureau of Standards, Washington, as to tests made preparatory to the recommendation of a method for the efficient inspection of gas, readers may be reminded that it was pointed out last week [p. 533] that the methods of determining the sulphur which are available for use for this work are of three kinds: Gravimetric, volumetric, and turbidimetric. In the following sections of the paper, four methods are given which have been tried out with solutions of the character obtained from the Gas Referees type of apparatus, together with a short series of comparisons which show that they are sufficiently accurate for this kind of work.

Method 1.—Gravimetric, with Evaporation to Dryness.

Dilute or evaporate the portion of liquid taken for analysis to about 300 cc.; add 50 cc. of concentrated hydrochloric acid; heat to boiling; then run in 10 cc. of 10 per cent. barium chloride solution through a tube or from a burette, delivering it at the rate of about 8 to 10 cc. per minute—stirring constantly during the addition. After evaporation to dryness on the steam bath, take up with 75 to 100 cc. of hot water; filter through a good, close-grained paper; and wash with hot water until the bulk of the filtrate and washings amount to 200 cc. In a weighed platinum crucible char the paper with a low bunsen flame and finally ignite until the precipitate appears white. Cool the crucible in a desiccator and weigh.

The precipitate now contains a small amount of silica, which may cause an error of 0·1 to 0·4 grain per 100 cubic feet in the apparent amount of sulphur in the gas. Bearing this source of error in mind, it is only necessary to correct for it when the amount of sulphur exceeds the legal limit by a small amount. The correction is easily made by moistening the precipitate with a drop of hydrofluoric acid and then one of sulphuric acid, drying, igniting, and weighing again. The silica is all removed by this operation.

Method 2.—Gravimetric Precipitation in Nearly Neutral Solution.

In the more common procedures for the gravimetric sulphur determination, the precipitation of the barium sulphate is made in nearly neutral solution. This method was used by us as follows: To the solution which is diluted or concentrated to about 300 cc., add two or three drops of methyl orange or *P*-nitrophenol solution * and neutralize with hydrochloric acid, adding this solution dropwise. Finally add 2 cc. of the 1 : 1 acid in excess. Heat to boiling, add 10 cc. of 10 per cent. barium chloride solution, boil five minutes, allow to stand on a steam bath for half an hour or longer, filter, wash, ignite, and weigh the barium sulphate as in Method 1. The precipitation, when always made in the presence of a fixed amount of acid, is always affected in equal degree by the solubility of the barium sulphate in the acid.

Under the conditions given, the loss from this source is negligible for the present work.

Method 3.—Volumetric.

A number of volumetric methods have been recommended for the determination of sulphates, several of which are suitable for use with the liquids obtained from the Referees and Hinman-Jenkins apparatus. Only one of these—a modification of that recommended by Hollinger—will be described.

Make up a solution of 50 grams $BaCl_2.2H_2O$ per litre and one of 30·5 grams $K_2Cr_2O_7$ per litre. To 300 cc. of water add 10 cc. of 1 : 1 hydrochloric acid and exactly 15 cc. (from pipettes) of each of the above solutions; heat to boiling; add two or three drops of a dilute solution of ferric chloride; then slowly add 10 per cent. of ammonium hydroxide until a precipitate forms which does not redissolve on stirring. Add 5 cc. of the ammonia solution in excess, boil five minutes; filter; wash thoroughly with hot water. Allow the filtrate to cool, acidify with hydrochloric acid, add two grams of solid potassium iodide or a solution containing that amount, and titrate with tenth-normal sodium thiosulphate, using

* Any other indicator sensitive to ammonia but not affected by carbon dioxide may be used.

starch as an indicator. The amount of this sulphate solution used in this blank is to be subtracted from the amount used in each subsequent determination.

To make a determination of the sulphate in a solution, dilute or concentrate the sample taken to 300 cc.; add 10 cc. of 1 : 1 hydrochloric acid; heat to boiling; add 15 cc. of barium chloride solution from the pipette used in the blank test; boil five minutes; add 15 cc. of potassium bichromate solution and a few drops of ferric chloride; precipitate with ammonium hydroxide; and complete the determination exactly as in the blank test. From the amount of thiosulphate solution used, subtract the amount required in the blank. The remainder represents the sulphate in the sample taken.

METHOD 4.—TURBIDIMETRIC.

The turbidimeter used (fig. 3) consists of a cylindrical glass tube graduated from the bottom in centimetres, surrounded and held in place above the light by a brass tube. The light used in most cases was a 16-candle power carbon filament lamp, so placed that a straight portion of the filament extended diametrically across just below the bottom of the tube.

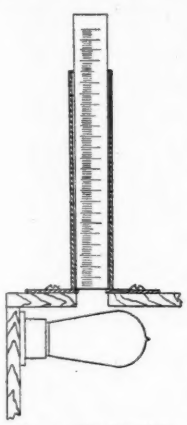


Fig. 3.—The Turbidimeter.

The following method was adopted after tests, the results of which are given later in this paper; and it is recommended for general use when a turbidimetric procedure is wanted.

The condensate and washings from the sulphur apparatus are neutralized with hydrochloric acid,* then 2c c. of the 1 : 1 acid is added in excess. The solution is measured to the nearest cubic centimetre and a 90 cc. portion is placed in a small beaker for the test. It may be measured in an ordinary graduated cylinder if it is certain that the ratio of the small cylinder to the larger measuring vessel first used is correct. While the solution is between 25° and 30° Fahr., 10 cc. of a 10 per cent. solution of $BaCl_2.2H_2O$ is added, and the whole stirred vigorously until the precipitation appears to be complete. [This usually requires less than one minute's stirring.]

The suspension is now poured into the clean and dry turbidimeter tube—a small portion at a time—until the filament of the lighted lamp disappears from view. After the first trial, the solution is poured back into the beaker, stirred vigorously, and the observation of the point at which the filament disappears is repeated until this is fixed within one millimetre. During the time the solution is being added, the portion remaining in the beaker should be kept well stirred, so that the small portions added from it will be representative of the whole bulk. The first time the solution is poured into the observation tube the latter must be dry and clean. In cleaning it care should be taken to remove (without scratching the tube) the film of sulphate which adheres so persistently to the bottom.

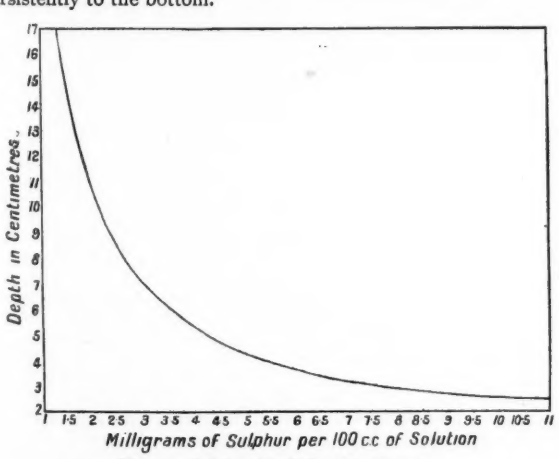


Fig. 4.—Sulphur Turbidimeter Curve.

Further tests on a second 90 cc. of the original neutralized solution of sulphate should be made, if considerable accuracy is needed. The amount of sulphur indicated by the curves of figs. 4 and 5, corresponding to the depth of liquid in the turbidimeter measurement, is multiplied by the number of cubic centimetres of neutralized condensate and divided by 90 (the volume of sample taken) to give the total amount of sulphur obtained by burning the gas. For convenience in this calculation the condensate after neutralization can be made up to 270 or 360 cc., and the observed values for the 90 cc. portion are then multiplied by 3 or 4.

The curves of figs. 4 and 5 may be used by any observer if care is exercised in following exactly the method given in the preceding paragraph. The acidity and temperature limits must be particularly observed; the character of light used is less important. In any case it is well for an inexperienced observer to take known amounts of a standard sulphuric acid solution, and run through the test until assured that his observations are consistent and correct.

* An indicator is required which is sensitive to ammonia but not to carbon dioxide. Para-nitro-phenol is the most satisfactory, because it is colourless in acid solution.

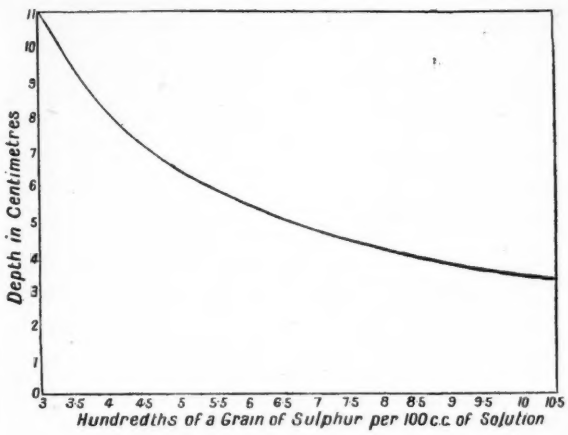


Fig. 5.—Turbidimeter Calibration.

Since little was known as to the effect of different conditions of operation on the result of the tests, a number of special comparisons were made, the results of which are given in the following paragraphs.

The incandescent filament gives a sharper end point than any other source of light so far devised. It is not affected by draughts, does not smoke or crack the tube, and can be conveniently placed under a table or in another out-of-the-way place. A series of comparisons, using the incandescent filament, the standard candle, and the 0·5 mm. slot recommended by Leighton, is given in Table VIII. In each case the same liquid was used with each source of light in turn. As can be seen, the three light sources give excellently agreeing results.

TABLE VIII.—*Comparison of Results with Different Lights in Turbidimeter.*

Incandescent Filament.		Candle.		Electric Light below a 0·5 mm. Slot.	
Depth of Solution.	Mg. Sulphur per 100 c.c. of Solution.	Depth of Solution.	Mg. Sulphur per 100 c.c. of Solution.	Depth of Solution.	Mg. Sulphur per 100 c.c. of Solution.
24·0 ..	1·13 ..	25·0 ..	1·12 ..	25·0 ..	1·12
20·3 ..	1·22 ..	20·6 ..	1·21 ..	20·4 ..	1·22
12·3 ..	1·77 ..	12·3 ..	1·77 ..	12·2 ..	1·79
11·6 ..	1·86 ..	11·8 ..	1·85 ..	11·6 ..	1·86
8·5 ..	2·48 ..	8·5 ..	2·48 ..	8·4 ..	2·51
7·2 ..	2·93 ..	7·0 ..	3·01 ..	7·2 ..	2·93
5·9 ..	3·60 ..	6·1 ..	3·50 ..	5 9 ..	3·60
5·4 ..	3·95 ..	5·4 ..	3·95 ..	5·2 ..	4·09
4·1 ..	5·25 ..	4·1 ..	5·25 ..	3·9 ..	5·55
3·7 ..	5·93 ..	3·8 ..	5·77 ..	3·7 ..	5·93
3·4 ..	6·50 ..	3·5 ..	6·26 ..	3·3 ..	6·70

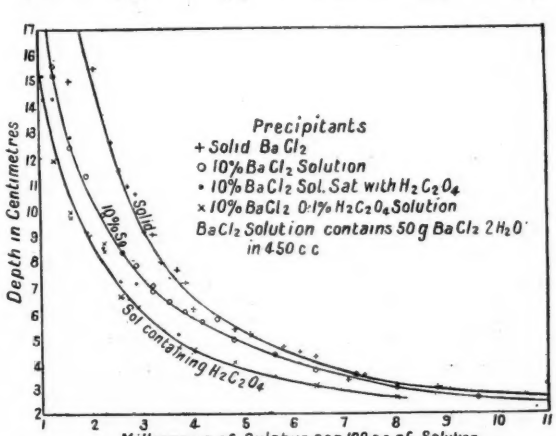

Precipitants
+ Solid BaCl2
o 10% BaCl2 Solution
• 10% BaCl2 Sol. Sat with H2C2O4
× 10% BaCl2 0·1% H2C2O4 Solution
BaCl2 Solution contains 50 g BaCl2 2H2O in 450 c c
Solid
10% Sol
Sol containing H2C2O4
Depth in Centimetres
Milligrams of Sulphur per 100 c.c. of Solution

Fig. 6.—Diagram Showing the Effect of the Precipitant Used upon the Sulphur Turbidimeter Curve.

The effect of using different precipitants as proposed by various persons who have used the turbidimeter for sulphate determinations, is shown in fig. 6. It will be observed that there is less variation where 10 per cent. barium chloride solution is used than with the other precipitants. The addition of oxalic acid gave a finer precipitate and a sharper end-point, but successive determinations were more discordant. Agreement of duplicates and certainty of result is most desirable in this method, since in any case the results are fixed by comparison with results on known amounts of sulphur. Variation of a single test from the average of all is

therefore serious, but the shape of the calibration curves is not of influence so long as regular calibration tests are made in the same way.

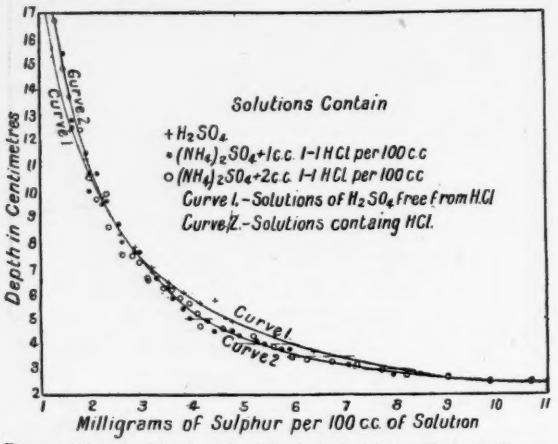

Solutions Contain
+ H_2SO_4
• $(NH_4)_2SO_4$+1c.c. 1-1 HCl per 100 c.c
○ $(NH_4)_2SO_4$+2c.c. 1-1 HCl per 100 c.c
Curve 1.-Solutions of H_2SO_4 free from HCl
Curve 2.-Solutions containg HCl.
Curve 2
Curve 1
Curve 1
Curve 2
Depth in Centimetres
Milligrams of Sulphur per 100 c.c. of Solution

Fig. 7.—Diagram Showing the Effect of the Hydrochloric Acid upon the Sulphur Turbidimeter Curve.

Fig. 7 shows the effect of small amounts of hydrochloric acid upon the turbidimeter curve. Larger amounts caused much greater variations. Fig. 8 shows the effect of the temperature of precipitation upon solutions of average strength. Fig. 4 is the curve drawn from the results obtained under the conditions of precipitation recommended above. Fig. 5 represents the same data as fig. 4 with concentrations expressed in hundredths of a grain, instead of milligrams.

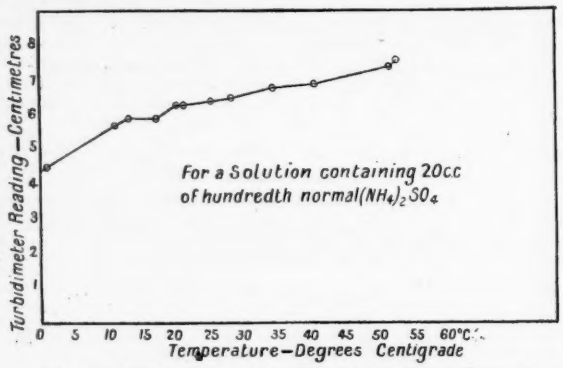


Fig. 8.—Diagram Showing the Effect of the Temperature of Precipitation upon the Turbidimeter Reading.

To show the accuracy of the method as used, one series of tests from which our conclusions are drawn has been summarized in Tables IX. and X. This summary shows the average and the maximum deviation of individual tests from the value calculated from the amount of standard sulphuric acid used—*i.e.*, the errors which were found by making a single precipitation of barium sulphate and suitable observations on it. When more than one portion is precipitated and used for a determination, the accuracy would be materially increased, so that in tests on three portions of a solution the average of the three ought not to be much more than 1 per cent. in error. It should be remembered that three tests can be made in this way much more quickly than a single test by any other method.

TABLE IX.—*Turbidimeter Errors.*

Sulphur (Mg. per 100 c.c.).	Average Error (Per Cent.).	Maximum Error (Per Cent.).	Number of Determinations.
1 — 2	2·9	8·7	13
2 — 3	3·5	7·1	13
3 — 4	2·5	7·7	17
4 — 5	2·6	6·3	8
5 — 6	1·3	5·2	7
6 — 8	2·6	5·6	7
8 —11	3·4	6·3	5
All values	2·7	8·7	70

TABLE X.—*Showing Percentage of Error of Determinations between 2 and 8 Mg. per 100 c.c.*

Error (Per Cent.).	Number of Determinations.
·0 — ·5	11
·5 —1·5	12
1·5 —2·5	5
2·5 —3·5	7
3·5 —4·5	3
4·5 —5·5	5
5·5 —6·5	6
6·5 —7·5	2
7·7	1
	52

From its very nature as a procedure using a standard of similar nature as the basis of calibration, the turbidimetric method must, on the average, give correct results; the variation of individual results from the average is, therefore, the important consideration. The data of Tables IX. and X. show that, when used with only ordinary care, it is applicable to work where approximate values (within 2 to 3 per cent. of the amount of sulphur present) are sufficient. To give an idea of the results to be had by the other three methods, Table XI. has been included. These data show the results which were obtained under conditions distinctly unfavourable to accurate results, only 6 to 30 mg. of sulphur and large and varying amounts of ammonium carbonate being present in the samples used. These conditions were chosen as representing those with which we had to deal in the gas-testing; and if in other work larger amounts of sulphur were present or greater care was exercised, no doubt much more exact results could be secured. For gas-testing, the accuracy here shown is ample, since it is greater than the accuracy obtainable in the condensation of the sulphate.

TABLE XI.—*Comparison of Methods for Sulphate Determination. Sulphur (mg. per Grain of Solution) in Standard H_2SO_4 Solution determined by Different Methods in Presence of Excess of Ammonium Carbonate, as otherwise noted.*

			Volumetric—Method 3.	
Volumetric against NaOH and Benzoic Acid.	Method 1 Gravimetric.	Method 2 Gravimetric.	Oxalate Standard (no Carbonate added).	H_2SO_4 Standard.
1·589	1·591	1·597	1·602	1·595
93	91	93	1·597	1 602
90	90	92	1·600	1·597
92	1·609*	99	1·599	1·601
92	1·596	97	1·602	1·596
92	96	92	—	1·589
89	88	99	—	1·574
90	92	91	—	1·575
—	94	1·600	—	—
1·591	1·592	1·595	1·600	1·589

* Omitted from the average.

The results of the first set in Table XI. by Method 3 are calculated on the basis of the value of thiosulphate solution obtained by titration against a permanganate solution, whose value was obtained against sodium oxalate. In the second series, the thiosulphate was standardized against the sulphuric acid value given in the first column of the table.

For accurate work the gravimetric methods are to be preferred. But for rapid work the turbidimetric and volumetric methods will serve very well; and, unless the tests indicate that the sulphur is very near the permissible limit, they are probably sufficiently accurate for official use. The volumetric method is adapted especially for use in State inspection, where a large number of test solutions are collected in the field work and subsequently examined at the headquarters laboratory. In most cases, however, the turbidimeter, which is easily portable, may be carried with the inspector, and a test made at the time the sulphate is collected —thus avoiding the necessity of transporting to headquarters the solution obtained.

French Gas Exhibits at the Ghent Exhibition.

The French Section of the Ghent Exhibition was opened early this month by M. Massé, the Minister of Commerce. The class devoted to lighting is under the supervision of a Committee, of which M. Cornuault, a Director of the Paris Gas Company, is the President; M. Massé, the Managing-Director of the Société d'Eclairage, Chauffage, et Force Motrice (the Company lighting the principal suburbs of Paris), and M. Laurain, the Consulting Engineer of the Paris Gas Company, are the Vice-Presidents; M. Vaudeau, the President of the Chambre Syndicale d'Eclairage et de Chauffage par le Gaz, is the Secretary; and M. Delamotte, the General Manager of the Société Française de Chaleur et Lumière, is the Treasurer. They have brought under the notice of the visitors to the exhibition an interesting collection of plans, drawings, photographs, pamphlets, &c., relating to the gas industry. The Company with which M. Delamotte is associated show "Pharos" lamps, upright and inverted burners working at ordinary pressure, gas-cookers, radiators, boilers, and bath heaters. M. Visseaux, of Lyons, exhibits a collection of high-power burners, Ramassot boilers, and silk and ramie mantles. M. Stein et Cie. have on view models and photographs of gas-furnaces. M. Th. Vautier, of Lyons, shows plans of gas-works, photographs of their principal features, and pamphlets on photometry. The other exhibits include automatic lighters and extinguishers, &c.

We learn from the Hon. Secretary of the Yorkshire Junior Gas Association (Mr. E. Garsed) that arrangements have been made for a visit to the works of Messrs. Drakes Limited, at Ovenden, Halifax, next Saturday afternoon. The firm are preparing to give the members an interesting afternoon; and at the close of the visit they will invite them to take tea. The Council have long desired to include in their sessional programme a visit to these works; and now that the opportunity has presented itself for doing so, they trust a large number of the members will avail themselves of it.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Criticisms of Recent Proposals Concerning Gas-Fire Construction.

SIR,—Before dealing with Messrs. Davis's request for the publication of the experimental data upon which my criticisms of their recent proposals regarding gas-fire construction were based, I must respectfully protest against the one-sidedness of your editorial intervention in the discussion, particularly as exhibited in your leading article of May 6, in which you commented on the argument of my article of same date.

Up to now, I have always respected and relied upon the judicial attitude of the "JOURNAL" on the various questions which from time to time are discussed in its columns; but in this instance I feel that you have seriously departed from the detached standpoint which disputants are entitled to expect of you while an important issue is still (so to speak) *sub judice*, and at least until the parties concerned have completed their arguments. As it is, I have to argue my case under a running fire of adverse editorial criticism, as though you had assumed the *rôle* of leading counsel for the other side.

When, on July 30 last, you published a eulogistic article (and a "leader" thereon) upon "Davis's Shadowgraph Method of Testing Gas-Fires" (which publication originated the present controversy), you committed yourself "after having examined the test, and watched in every detail a demonstration, during an entire afternoon" to the view that if their proposed new standard of hygienic efficiency "can be obtained by a fire (as demonstration shows it can be obtained) without the assistance of chimney and flue pipe, then, between such a fire and one that needs a flue to obviate escape of products under the canopy, there is a margin of advantage to the credit of the former, that has a value to both gas supplier and gas user," to which you added, by way of emphasis, that "that is a plain, incontrovertible submission."

Again, when my first criticism of the new proposals appeared in your issue of Sept. 3 last, you did not wait for my opponents to reply; but, making their cause yours, you published, in the same issue, a leading article traversing my main arguments and defending my opponents' position. Finally, when, a fortnight ago, I replied to their repeated challenge for a disclosure of the experimental basis of my views, you again intervened on their behalf in the same issue with a leading article which does its utmost to discount and discredit what I had written; and that before readers had got the length of reading it. This left little to my opponents but to "cross the t's and dot the i's" of your leading article, which, as they declare in their communication of May 13, "puts the case so admirably" that, pending my replies to your "various pertinent queries," they feel relieved of any present onus of dealing with my criticism. This being so, I must identify you with my opponents' case, and reply to your article of May 6 as though it had emanated from them.

Coming now to the specific points raised in your leader of May 6, I cannot acquiesce in your attempt to enlarge the issues so as to include any other question than the one under discussion—such, for example, as the question you raise, of whether "the slight dropping of the canopy of a gas-fire increases the 'ventilating effect' more than a length of flue-pipe attached at the back of the fire, &c." I cannot allow either you or my other opponents thus either to confuse the original issue or to run away from it.

With regard to the issue submitted to Professor Bone, it must obviously be considered as arising directly out of the opposite statements made by the parties concerned during the earlier stages of the present controversy, and not as something apart therefrom. Messrs. Davis had claimed (on July 30 last) for a particular new construction of fire, not only that (1) it satisfied their proposed new standard of hygienic efficiency—namely, that without the aid of any flue attachment whatever, all the products of combustion shall pass away through the flue outlet, but also (2) that the space allowed between the front edge of the canopy and the refractory mantles is carefully proportioned so as to allow a large volume of ventilating air to be drawn into the flue without in any way affecting the radiant efficiency of the fire.

Let it be noted, in passing, that this latter claim is (to borrow a phrase which you used in an earlier stage of this discussion) "dogmatic assertion or pure assumption," and has never yet been supported by any published experimental data. Commenting upon it (on Sept 3) I ventured to assert—obviously, again, in reference to the new construction—that a fire so constructed, and carrying off all its products without being attached to a flue, will, when the ordinary chimney draught comes into play, inevitably carry off more than the products—to wit, an unnecessary number of heat units as well. This, as I clearly stated in my article, was the issue submitted to Professor Bone; and as I also clearly stated, the whole history and circumstances of the case were put fully before him.

When my criticism appeared, Messrs. Davis, ignoring the fact that *they* had not advanced a vestige of experimental proof in support of their important claim (2), demanded the instant publication of my rebutting evidence. In other words, they would seem to claim for themselves immunity from the very obligation (in the way of proof) which they insist upon their critics so scrupulously observing.

To those who have followed the course of this controversy, it will be evident that if, in regard to the new construction, my opponents' claim is right, then the radiant efficiency of a fire *so constructed* must, within fairly wide limits, be independent of the chimney draught to which it may be subjected; whereas, on the other hand, if my criticism of their claim is well-founded, the radiant efficiency of such a fire must progressively diminish with increasing chimney draught, and on this point the report of Professor Bone is quite conclusive in my favour.

With regard to your request for the publication of details relating to Professor Bone's investigation at our works, I may say that all figures were excluded from my article of May 6 for two reasons, viz., (1) because the publication of figures resulting from Professor Bone's investigation would have been inconsistent with the condition laid down by him (and accepted by us) when he first undertook our commission—namely, that he should not be called upon to express in public any opinion as to the relative merits of fires of our own or other firms' manufacture, but should confine himself to principles of construction; and (2) because the prime object of Professor Bone's investigation was to enable him to arrive, independently, at a correct judgment on the issue involved, without reference to any previous results or arguments of our own, or to the views of third parties.

In view, however, both of your leader of the 6th inst., and of Messrs. Davis's repeated request on the 13th inst. for details (including the names and sizes of the two fires tested), I have obtained Professor Bone's permission to give the following particulars of the tests on which his recently published opinion is principally founded. It must be understood that Professor Bone has agreed to this as a concession, and not as a matter of right or necessity, because in his fiduciary position to us, as our consultant, he is responsible only *to us* for the reasons for his opinion, and not to any third party. Moreover, the whole responsibility for the disclosure of these details must, of course, rest with those who have so insistently demanded them. The figures are as supplied by Professor Bone; the comments thereon are mine. I may add that the selection of the particular sizes of the fires tested was determined by the consideration that, according to our experience, they are those principally demanded by the public.

The two fires selected for the investigation were (1) a Davis barless No. 1 "Vesta" fire (referred to hereafter as Fire X), as embodying the new construction proposals, and (2) a Wright 10-inch "Wizard" fire (referred to hereafter as Fire Y), as embodying the opposite type of canopy construction. The two fires had practically the same overall dimensions, number of burners, and rated consumptions, but differed considerably in the respective distances between the top of the radiants and the bottom of the canopy. For the further identification of the two fires the following particulars will suffice:—

	X.	Y.
Width in front across radiants	9½ in.	10 in.
Number of burner teats and vertical radiants	7	7
Vertical distance between bottom of canopy and top of horizontal radiants .	⅛ in.	3⅜ in.

Each fire, when under test, was fixed in position in a rectangular room, of floor measurements 14 feet by 18 feet, and of 2758 cubic feet capacity.

Care was taken (1) so to regulate the gas consumptions that the number of heat units (*net*) developed per hour at the seven burner teats during each test was practically constant (say 3100 to 3200 K.C.U.'s per hour) throughout the various tests. (2) The flue vent of each fire and all flue connections (when such were attached) were lagged with slag-wool, in order that the temperature of the flue products recorded in each experiment should represent the true mean temperature of the products actually vented by the fire.

Radiation tests were made according to the method adopted by the Joint Committee for the Investigation of Gas-Fires appointed by the Institution of Gas Engineers and the University of Leeds in 1907. Determinations of the calorific values of the gas burned were made at half-hourly intervals during each test; and analyses were made, from continuous samples, of the flue products in each case. Comparative tests on the two fires were made under three conditions of draught—namely (A) *Without any flue attachment at all*, the products of combustion simply passing away through the flue vent of the fire, unaided by any flue draught; (B) *Under moderate flue draught*—the fire being connected by means of a 3 ft. 10 in. length of lagged flue pipe to a brick chimney 25 ft. 9 in. in height above the point of entry of the said flue pipe; and (C) *Under strong flue draught* (with similar arrangements as in B), which reduced the percentage of CO_2 in the flue products to approximately one-fourth that found in series (A) in each case.

It may here be remarked that the difference between draught conditions B and C respectively was due to external weather and meteorological conditions. Such experimental conditions, it will be admitted, were calculated to bring out the effect of increasing draught upon (1) "radiant efficiency" primarily, (2) "flue heat" (*i.e.*, heat losses in the flue), and (3) "ventilating effect" (as indicated by the percentage of CO_2 in the flue gases).

TESTS WITH FIRE "X."

	A.	B.	C.
Percentage CO_2 in flue products .	3·43	1·60	0·87
Temperature of flue products—C°.	275°	163°	140°
†Relative radiant efficiency . . .	0·84	0·81	0·68
*Relative "flue heat" loss (approximate)	1·20	1·40	2·15

TESTS WITH FIRE "Y."

	A.	B.	C.
Percentage of CO_2 in flue products	3·17	1·17	0·76
Temperature of flue products—C°.	217°	103°	100·7°
†Relative radiant efficiency . . .	1·00	0·92	0·91
*Relative "flue heat" loss (approximate)	1·00	1·10	1·75

* Expressed as an approximate ratio of the *lowest* "flue heat" loss observed—namely, in Y A experiment.

† Expressed as a ratio of the *highest* radiant efficiency observed—viz., in Y A experiment.

The above figures hardly need comment to bring out their full significance; but as they have been published in response to the demands of the other side, perhaps I may be allowed to point out how completely they support my contentions.

In the first place, while both fires show a diminishing "radiant efficiency" as the flue draught increases, it is noteworthy that, with strong draught, the falling-off is very much greater in the case of X than in Y. Moreover, the *lowest* "radiant efficiency" obtained with Y (under strong draught, and with 0·76 per cent. of CO_2 in the flue products) is greater than the *highest* obtained with X (without flue attachment, and with 3·43 per cent. of CO_2 in the products). Therefore it is manifest that, whatever the new construction may or may not do in other ways,

the claim of its proposers, that it allows a large volume of ventilating air to be drawn into the flue "*without in any way affecting the radiant efficiency of the fire*," must be dismissed.

In the second place, the figures for the "relative flue losses" show that, in both fires tested, the diminishing effect upon "radiant efficiency" of increasing flue draught is accompanied by an increase in the flue losses—a feature which is particularly marked in the case of the new construction X. This completely substantiates my contention (in regard to the new construction) that a fire so constructed, and "carrying off all its products without being attached to a flue, will, when the ordinary chimney draught comes into play, inevitably carry off more than the products—to wit, an unnecessary number of heat units as well."

Finally, a comparison of the results of the tests disposes of the alleged superior "*hygienic efficiency*" of the new construction over other types of fire, because the CO_2 figures show that when X and Y were attached to the same flue, and subjected to the same draught, Y actually ventilated the room much better than X.

Seeing then that (as the foregoing figures show) the "radiant efficiency" of the new construction is not only absolutely lower, but also more susceptible to the lowering effect of a strong draught, than the old, and seeing also at the same time that the new type of fire, when subjected to the same ordinary chimney draught, is a less efficient ventilating agent than the old, it follows that the often reiterated claims made for the superiority of the new construction are destitute of scientific basis.

I have already, in answer to the repeated challenges made to me, published a report by an entirely independent investigator, Professor Bone, which fully substantiates my original statement. I have now, in response to the further challenge of the "JOURNAL" and of Messrs. Davis, set forth in detail the results of the investigations on which Professor Bone's report was founded; and these figures amply justify my article of May 6, as well as my original statement. Having thus vindicated my position in the fullest possible manner, I am content to leave this important question to the judgment of the industry at large.

H. JAMES YATES.

Birmingham, May 22, 1913.

Gas-Fire Construction.

SIR,—Your correspondent "Experimenter" makes an interesting suggestion in his letter published in the "JOURNAL" for the 20th inst. He refers to a simple test which can be carried out by the aid of an 8-inch square of stiff sheet copper, well nickel-plated, and states that, when cooled and placed at the edge of the canopy of a gas-fire, any escaping products of combustion are at once detected. But your correspondent does not state in what way the products act upon the nickel-plated copper. It would be interesting if he will give this further information.

ENQUIRER.

May 21, 1913.

Scientific Carbonization.

SIR,—Mr. Toogood is once more in evidence with belated claims.

Scientific carbonization has not so much to do with "dotting the i's" as with "dotting the o's," which appears to be the all-important object Mr. Toogood so consistently keeps in mind.

If anything remains to be allotted in shares of work and honour attending the undoubted success of the carbonization of coal in vertical retorts, Mr. Toogood had better be quick and give some results of the system and processes which he again claims originated with himself.

The introduction of the Dessau system into this country is apparently kept uppermost in Mr. Toogood's mind, and doubtless the results obtained at East Hull are felt to bear favourable comparison. Hence the "mixed feelings" which Mr. Toogood confesses remain with him.

CONSISTENCY.

May 24, 1913.

Corrosion of Steel Mains.

SIR,—I have been reading with interest the remarks and discussion upon steel mains for gas distribution, and also the strong advocacy of their use, and practically nothing of the other side of the picture.

It is as well to be quite sure of the ground and the soil before steel pipes are decided upon. Here, in Port Elizabeth (South Africa), we have had, and are having, a very bitter and expensive experience in connection with the pitting or corrosion of a fairly new steel main supplying the town with water from the Sand Palmiet and Bulk River, at a distance of some forty miles. These pipes were only laid in 1907, some six years ago; and now, according to our Town Engineer, they are very badly pitted, and full of holes. These are being plugged up daily at the rate of about twenty a week. The pipe is eaten away or pitted from outside, not from inside, and some of the holes are of large diameter. The leakage of water was upwards of 2 million gallons per week; but this has been somewhat remedied by plugging.

The pipes were supposed to have been dipped in hot bitumen solution and carefully treated. The Town Engineer reported that he thought the whole main would have to be replaced with cast-iron pipes; and this will cost the town some £200,000—no small item in a little community like ours. Experts have been called in, and they say, in a preliminary report, that the damage is not so bad as it is thought to be. However, the Council are replacing some ten miles of this steel main right away with cast-iron mains; and from what one has personally seen of the main, there is no doubt that ultimately the whole length will have to be renewed with cast-iron pipe. The main is now being cleaned, and painted with hot bitumen and pitch. This pitting is due to the action of the soil upon the pipe—eating clean into it.

In Main Street—our principal thoroughfare—a new 6-inch steel water-main was laid only five years ago; and it has all been pulled up and renewed this year with cast-iron pipe owing to the severe action of pitting on the pipe. The soil in Main Street is of a sandy gravel, and, in my opinion, good stuff to work it in. We have many wrought-iron services laid there. Some have been in for more than twenty years, and are not in bad condition. Our cast-iron 12-inch main has been down nearly forty years, and looks as good as new; yet the same soil eats clean through steel pipe. Many theories have been put forward to account for this action upon steel, but no real accepted one.

Personally, after seeing what I have seen, and hearing the reports from other towns in South Africa having similar experience with steel pipes, I would not think for a moment of putting down these pipes here as gas-mains. If you were sure of a perfect coating of bitumen or pitch mastic, then you might feel safer. But men out here are only human, and coating does, and will, chip off. "No chain is stronger than its weakest link" is a true adage.

Perhaps these few facts as to the life of steel mains may be of service to some engineers and managers who are in doubt, and want to be sure of the best class of main to lay. My advice is: "Don't trust to steel mains for a long life."

WILLIAM ARNOTT.

South African Lighting Association, Port Elizabeth, May 5, 1913.

Premier Tarless Fuels, Limited.

SIR,—Your leader and description of the plant erected by the above Company at Battersea, and the emphasis which is laid upon the principle of carbonization under a high vacuum, remind me of my patent specification of 1909 relating to the Edinburgh vertical retorts and subsequent publications referring to this very point.

Reference to the specification and the drawings accompanying the same will, I think, conclusively show that I anticipated these conditions in the construction of my verticals, not only so far as the retorts themselves were concerned (which for this reason were constructed of specially formed bricks), but also so far as the subsidiary ironwork, including the longitudinal conveyor feeding the coal-hoppers, the hoppers, and all the apparatus associated with the feeding of the coal and the discharge of the coke into the conveyor beneath.

W. R. HERRING.

Palace Chambers, Westminster, May 21, 1913.

National Gas Institute.

SIR,—It appears to me most desirable in the permanent interests of gas undertakings that a fund should be commenced, having for its object the ultimate building of such an Institute.

The magnificent efforts in the past in extending the use of gas, particularly of the large London companies in a variety of ways both separately and collectively, would be most effectually consummated by the establishment of a permanent Institute. In addition, vigour would be given to gas undertakings which are now conspicuously behind the times. Some may be inclined to argue that it is the sole business of each individual undertaking, but such is not the case. Communities exist for mutual benefit. Deplorable results from one undertaking indirectly affect all. Without interference, one able example demonstrated would be the best possible method of stimulating another undertaking. How much has been accomplished during the past thirty years is well known; but the possibilities of the future are beyond all consideration. Concentration and union would result from a strong central organization.

If a fund were commenced under the auspices of the Institution of Gas Engineers with the present machinery, developments would speedily follow.

EDWARD A. HARMAN.

Huddersfield, May 20, 1913.

Edinburgh Public Lighting.

The Wholesale Fittings Company, Limited, have sent us a letter on this subject, in the course of which they say: With reference to the correspondence which has lately appeared in the "JOURNAL" in regard to the lighting of the streets of Edinburgh, we shall be pleased if you will kindly permit us to say a few words before the correspondence finally closes. We would only like to add to Mr. Herring's interesting letter [*ante*, p. 464] the fact that not only was the "Star" inverted burner "originally" adopted by the lighting authorities, but that it is still used. We agree with Mr. Herring that, at the outset, there was considerable difficulty with manufacturers over the making of the proper orifices in the injector nipple by which the inlet of the gas is regulated; but this was long ago overcome, and the right gauge obtained. The burner gives the maximum amount of illumination to be obtained with a consumption of 2½ cubic feet of gas per hour, and at the same time, by the proper regulation of the air-valves, it can always be adapted for use with gas of other qualities and supplied at different pressures than that at Edinburgh. At the gas exhibition in Edinburgh last year, the burner as in use in the streets was on show on our stand.

South African Lighting Association, Limited.—The report of the Directors of this Association for the year 1912, to be presented at the ordinary general meeting to-morrow, shows that at both Port Elizabeth and Grahamstown there was an increased consumption of gas and also a larger number of consumers compared with 1911. After many experiments, the Directors have entered into a contract for the purchase of a considerable quantity of Colonial coal for use during the present year. They have reduced the price of gas at Port Elizabeth from the 1st of February by a substantial amount. During the year, they had the advantage of conferring with Mr. W. Arnott, the Manager, who returned to his duties in December last. They recommend an increase in the dividend; for, after placing £1000 to reserve, they propose the payment of 9 per cent. for the year, subject to deduction of income-tax, against 7½ per cent., tax free, a year ago. Of this dividend, 3½ per cent. was paid in October last; leaving 5½ per cent. now payable. A sum of £750 has been taken out of reserve to write-down reserve investments, which will now stand below their market value on Dec. 31 last. After payment of the dividend, there will remain to be carried forward £2160, compared with £1500 brought forward.

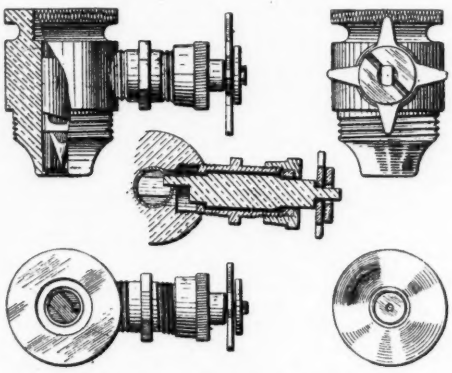
REGISTER OF PATENTS.

Regulators for Gas-Burners.

PROSSER, H. R., of King's Heath, Worcestershire.

No. 8691 ; April 12, 1912.

In this arrangement the gas is regulated at the jet or jets from which it issues by needles or equivalent members provided upon a sliding member within the body of the jet, and operated longitudinally by an eccentrically mounted pin upon a hand-operatable rotating member projecting at right angles from the body of the jet.



Prosser's Gas-Burner Regulator.

The rotating member (as shown) is furnished, as usual, with a barrel rotating but not screwing within a cylinder, so as to provide a prolonged annular channel which the gas would have to traverse in escaping. But the present invention is characterized in that the barrel member is "satisfactorily adapted" to prevent any escape of gas "without a spring, which is liable to give trouble in view of the heat of the burner, and also without involving the necessity for a packing composed of readily compressible substance," although in the preferred form described a lead washer is employed.

The barrel is retained in the cylinder against an annular shoulder by a perforated cap, furnished internally with a washer of lead offering a shoulder which engages with a shoulder of the barrel, while a reduced extension of the barrel passes out through the perforation in the cap and carries a part by which the barrel may be rotated by hand.

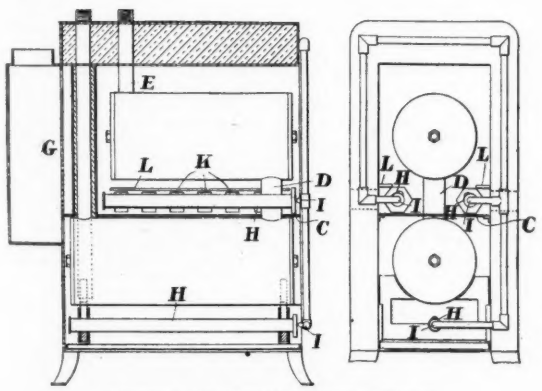
The illustration shows a front part-sectional view of a regulator according to the invention, with a side and top view of same; also a sectional view of the jet-operating mechanism, showing particularly the prolonged and obstructive course necessary to prevent the escape of gas.

Gas-Heated Water-Circulators.

STIMSON, E. F., of Upper Tooting, S.W.

No. 9538; April 22, 1912.

The object of this invention is to provide a circulator by means of which "economy in fuel is effected and a more rapid supply of water is obtained than hitherto." To this end, it is proposed to employ primarily two or more boilers or water chambers, constructed in accordance with patents No. 29,011 of 1911 and No. 52 of 1912, arranged in series.



Stimson's Gas-Heated Water-Circulator.

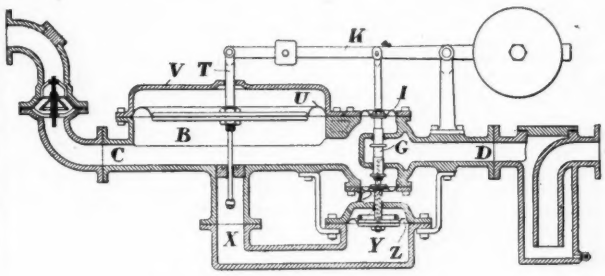
As shown, two water chambers are arranged one above the other (the upper one being the shorter of the two) and are enclosed within a casing provided with a transverse partition C to divide it into two. The water chambers are united by a short pipe D, while the flow pipe E leaves the top of the chamber and the return pipe enters the top of the lower chamber and passes through to near the bottom of it. Both the flow and return pipes are connected-up to the water system of the building. Each compartment communicates with a common flue chamber G (mounted at the rear). Beneath the top water chamber are two burner pipes H, each presenting an open end to a gas-supply jet I connected to pipes communicating with the main gas supply. Air-inlet openings K are formed through the walls of the casing beneath baffle plates L projecting within the casing.

Controlling the Flow and Pressure in Fluid Distributing Systems.

MITCHELL, E. A., of Broad Street Avenue, E.C.

No. 9835 ; April 25, 1912. No. 11,611 ; May 15, 1912.

This conjoint invention relates to systems for the distribution of high-pressure fluid (such as gas or air), wherein a reducing valve is employed to automatically control the flow of fluid from one part of the system to another lower pressure part in accordance with the consumption of fluid or the pressure variation due to an equivalent cause.



Mitchell's Gas-Pressure Controller.

The illustration shows the form of regulator adapted to supply service pipes with gas at a pressure of 2 oz. to the square inch reduced from a pressure of 50 lbs. per square inch—the parts of the regulator being in the working position.

A casing is employed having a diaphragm compartment B and a low-pressure outlet C at one end separated from a high-pressure inlet D at the other end by the seatings of an ordinary balanced pressure reducing valve G. The stem of the valve protrudes above and below the casing part and is connected to it in a fluid-tight manner, by flexible diaphragms I, the upper extremity having a loose connection with a weighted lever K, pivotally secured at one end to a stem T connected to the diaphragm U of the low-pressure regulator ; this diaphragm being clamped to the top of the compartment B by a protecting cover V. Co-axially with the diaphragm U, and beneath the bottom of the compartment B, is a branch adapted to be connected to the branch X of a high-pressure chamber Y co-axial with the pressure-reducing valve G. The lower end of the stem of the valve G extends into the chamber Y and is connected to it in a fluid-tight manner by a flexible diaphragm Z, a passage and lateral port in the stem permitting fluid from the high-pressure inlet D to enter the chamber Y. Communication between the diaphragm compartment B or low-pressure side of the apparatus and the chamber Y is controlled by a vent valve, movable with the diaphragm U, and adapted to be advanced towards its seat as the diaphragm moves upwardly, and to be held against it by fluid in the pressure chamber Y.

The operation of the system is as follows: Assuming that the low pressure is that for which the regulator is set, then the diaphragm U will occupy some such position as that shown where the valve G is more or less open and also the vent valve, so that the high-pressure fluid that leaks into the chamber Y by way of the passage and port in the stem of the valve G will be dissipated in the low-pressure part of the system. If, however, the pressure in the low-pressure part increases, the diaphragm of the regulator will rise and in so doing rock the lever K and move the valve G nearer to its closed position—this continuing, if the pressure continues to rise, until the vent valve is closed. When this happens, the fluid in the high-pressure chamber Y accumulates and gradually completes the closure of the valve G—the loose connection between the stem and lever permitting of this independent movement. When the pressure of the low-pressure part of the system falls sufficiently to render it necessary to again supply fluid thereto, the diaphragm U will descend and open the vent valve, whereupon the pressure in the chamber Y will be reduced and the valve G permitted to open.

Mantles for Incandescence Lighting by Gas.

COLAS, C. L., of Paris.

No. 25,360 ; Nov. 5, 1912. Convention date, April 25, 1912.

The patentee remarks in his specification: Since the invention of Dr. Auer, the problem has been to reinforce or strengthen the mantles for incandescence lighting by gas, and to overcome their fragility and friability ; and a great deal of research has been made, and many patents applied for, relating to this object. He says he has studied the question for a long time and has "succeeded in bringing it to a practically useful result by the following means."

Various inventors have proposed to associate the solution of thorium nitrate and cerium nitrate, into which the mantles are dipped, with aluminium or magnesium silicate or with calcined china "biscuit" pitcher or with china clay, all of which varieties of clay are admixed with various substances. Pipe clay alone or mixed with asbestos has also been proposed [see Jameson's patent No. 2878 of 1904] ; but extended investigations have shown that these attempts to reinforce or strengthen incandescence mantles give unsatisfactory results, and that none but the purest clay—namely, kaolin, without any admixture whatever—secures the desired result. His investigations have further shown that the amount of kaolin should not exceed 5 per cent. of the liquid mixture of the nitrates into which the mantles are dipped.

In carrying out his invention he proposes to use a quantity of kaolin which does not exceed the above limit, and is preferably comprised

of between 3 and 5 per cent. of the liquid mixture—the proportion adopted being such that it simply disturbs the limpidity of the liquid mixture, and that the particles of kaolin (which is in a state of fine division) do not constitute too large a mass relatively to the particles of rare earths which are to envelop them. Into the liquid thus prepared the mantle fabric is dipped, care being taken that "the liquid is so stirred as to insure that the kaolin is properly kept in suspension and properly penetrates the immersed fabric together with the saturated solution of the other ingredients."

After from fifteen to twenty minutes, the fabric is withdrawn from the liquid mixture, and any excess of liquid removed. To allow it to regain a certain strength, the saturated fabric is then spread out on a smooth plate (of glass or porcelain) at a temperature of from 30° to 45° C.

The fabric thus treated, it is said, is easy to work, because it has become almost plastic, just as if it were coated with a kind of sizing. It is therefore possible to give it (by cutting out and stamping) any required form, "such as the shape of flowers of any kind, balls, mantles, and the like."

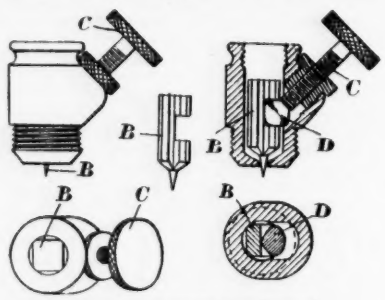
The incineration may be effected as follows: The articles are, as in the ordinary process, subjected to the action of a gas-flame, care being taken to allow them to burn outside the flame until the article has become completely white. It is then placed again in the burner-flame, wherein it hardens in a few seconds, or the articles may be placed in a porcelain oven in which the incineration and baking are effected very regularly. The articles after being baked are said to have not only the appearance of porcelain, but also its solidity; and the light obtained on any bunsen burner is "very fine and of great whiteness."

Gas-Burners.

SMITH, H. C., of Birmingham.

No. 13,954; June 15, 1912.

This invention comprises "a regulating stem movable axially in a body part, and formed with a gap having a pair of parallel sides at right angles to the axis of the stem, and an actuating screw formed with a double conical head adapted to abut against the parallel sides in the stem and arranged obliquely to the axis of the stem."



Smith's Adjustable Gas-Burner.

The body of the regulator is internally screwed at one end for attachment to the supply pipe; and at the opposite end is a small central aperture for the passage of the gas to the burner. Into the aperture there projects the needle point of a regulating stem B adapted to slide within the body part. Positive regulating movements in both directions are imparted to the stem by an angularly disposed operating screw C having a double conical inner extremity D, which engages a lateral recess in the stem. The end surfaces of the recess in the stem are at right angles to the axis of the stem, and the operative sides of D are parallel to each other as shown. On rotating the screw in the one direction, the regulating stem is moved in the direction necessary to cause its needle-pointed end to be gradually forced further into the outlet orifice for the gas; while, on turning it in the opposite direction, the needle end is withdrawn. Thus "the gas supply can be very finely adjusted to suit requirements."

Direct Recovery of Ammonia from Coal Distillation Products.

No. 28,072; Dec. 5, 1912. Convention date, Dec. 6, 1911.

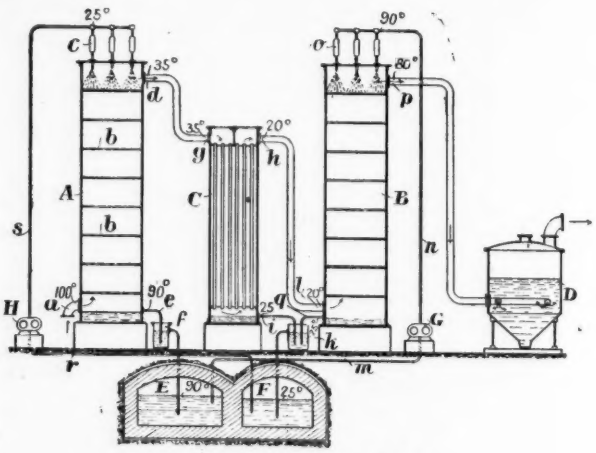
STILL, C., of Recklinghausen, Germany.

Alluding to his invention, the patentee says: The direct process for recovering ammonia from the products of the destructive distillation of coal consists in removing the tar from the products and passing the gases through an acid bath so as to convert the ammonia into a solid salt. The usual method of carrying out this process consists in cooling the hot crude gases to atmospheric temperature in tubular coolers fed with cold water, in order to eliminate the tar, and then conducting the gases through an acid bath wherein the ammonia is separated in the form of a solid salt. The objections to this method are that the cooling of the gases by means of tubular coolers—that is, cooling indirectly—necessitates installations of great dimensions, and that, during the process of cooling, large quantities of water of condensation (containing ammonia) are produced, which must be treated by steam and lime in special apparatus in order to recover also this amount of ammonia. It follows that this method, as contrasted with the older method—consisting in washing out the whole of the ammonia by water and then distilling it—represents only a partial success and only a small improvement.

The first mentioned objection—namely, the troublesome process of cooling the gases—can, he points out, be avoided by cooling directly—that is to say, by means of water injected directly into the gases and brought into intimate contact with them. The direct cooling of the gases is very efficient, and requires cooling apparatus of very small dimensions. If such a cooling is effected by causing the gases to meet the water travelling in the opposite direction, the gases can easily be cooled nearly to the initial temperature of the injected water, while, on the other hand, the outflowing water is heated nearly to the temperature of the incoming hot gas. This process allows of thorough separation of the tar than is possible by the usual cooling in tubular coolers.

When the gases are cooled by means of cold water brought into direct contact with them, water and ammonia are separated from the gases in the same way as in the indirect cooling; the two materials mixing with the cooling water in the present case. The ammonia and water thus separated from the gases can again be introduced into the gases, now freed from tar, by causing the hot water to travel through the cooled gases flowing in the opposite direction in the second stage of the procedure, in exactly the same manner as in the first stage, when the gases were treated by water for the direct cooling. By means of this second treatment of the gases by water, the gases can, on the one hand, be heated nearly to the temperature of the injected hot water, and, on the other hand, the water can be cooled nearly to the temperature of the incoming cold gases.

According to the present invention the two procedures mentioned—namely, the direct cooling and the subsequent re-heating—are combined "with the greatest advantage," when one and the same quantity of water is used in circulation, and the gases under treatment are subjected to a special intermediate cooling between these two stages. It appears that the temperature of the gases under treatment is, towards the end of the first stage (the direct cooling), somewhat above that of the water coming in here, and at the subsequent beginning of the second stage (the direct re-heating) somewhat below that of the water leaving here. Now, by producing a decrease in the temperature of the gases between the two points, the result is attained that, at both places, the temperature of the water can always be the same, and consequently the cold water running off from the heating apparatus can be charged immediately afterwards as cooling medium in the direct acting cooler. By means of this arrangement, "a complete continuous circulation of the water within the whole system may be maintained; the water being used alternately for direct cooling and direct heating of the gases to be treated."



Still's Ammonia Recovery Plant.

The illustration is a diagrammatic vertical section through plant comprising the invention.

A is the column in which the crude gases are cooled; B, the column in which the cooled gases are re-heated; C, the heat interchanger; and D, the saturator, in which the ammonia is absorbed by acid. The reservoirs E and F collect the liquors flowing from the columns A and B respectively, and G and H pump these liquors to the columns in which they are used. The temperatures marked relate to the gases and water flowing at these places, and merely serve to illustrate the principle involved.

An exhauster (not shown) draws the hot crude gases into the column A at *a*. The gases flow upwards, in the opposite direction to the cooling liquor, which is pumped by the pump H through pipes *r s* from the reservoir F to the top of the column, where it flows through sprays *c*—being distributed in the column by a number of perforated partitions *b*. The temperature of the gases entering at *a* may be supposed to be 100° C., and that of the cooling liquor entering at the sprays 25° C. The cooled gases leave the column at *d* at a temperature higher than that of the entering liquor—say, 35° C.; and the heated liquor flowing from the bottom of the column at *c* leaves at a temperature lower than that of the entering gases—say, 90° C. By cooling the gases as described, the whole of the tar and a quantity of the water contained in the crude gases are condensed and mix with the cooling water. This liquor flows through a seal-pot *f*, and thence into the reservoir E, where the tar separates from the liquor. Gases pass from *d* and enter at *g* the heat interchanger C, which is a tubular surface condenser wherein the gases are not in direct contact with the cooling water which flows around the tubes. The object of this interchange is to cool the gases to about atmospheric temperature—that is, from about 35° C. to about 20° C. This cooling entails the condensation of a small quantity of liquor which flows into the seal-pot *k* at an average temperature of 25° C. The cooled gases pass from the heat interchanger C at *h* into the heating column B at *l*. This column is of similar construction to column A, but its function is of an opposite nature—the cooled gases being re-heated by the hot liquor pumped from the reservoir E through the pipes *m n* to the sprays *o* at the top of the column.

In the column the gases, in being heated, cause the evaporation of a quantity of water which suffices to saturate completely with aqueous vapour the gases issuing from the column at *p*. The temperature of

the gases at this point may be about 80° C.; and they contain practically all the ammonia in the original crude gases and deliver it to the acid in the saturator D. The liquor, leaving the bottom of the column B at a temperature of 25°, flows through the pipe *q* and the seal-pot *k* into the reservoir F, together with the condensed liquor from the heat interchanger. From this reservoir the liquor is pumped again through the pipes *r s* to the spray *c* at the top of the column A.

In order that the apparatus may work satisfactorily, the patentee says, it is important that the hot gases entering the cooling column A should contain as much heat as possible. This could, of course, be assured by heat insulation of the pipes conducting the gases to the column; but it is a feature of this invention that the heat capacity of the crude gases is increased by increasing the proportion of aqueous vapour carried by them in the following manner: A certain proportion of the liquor collected in the reservoir E—namely, an amount generally representing a part, or at any rate less than the whole, of the water carried by the crude gases and condensed during the cooling thereof—is removed and introduced into the hydraulic main, where it is evaporated by the heat of the hot crude gases. This evaporation lowers the temperature of the crude gases; but, on the other hand, the heat is carried by the aqueous vapour passing into the gases and is re-converted into sensible heat, which appears in the water used in circulation, by condensation of the vapour in the column A.

Gas-Fires.

FLAVEL, P. W., of Leamington.

No. 28,161; Dec. 6, 1912.

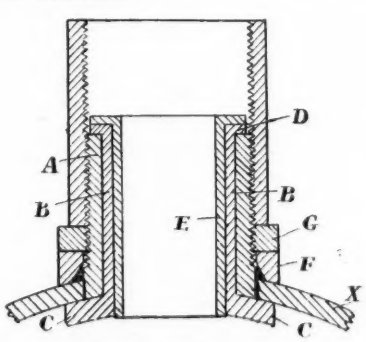
This is a modification of the invention described in patent No. 5875 of 1912, which "described a gas-fire comprising a sloping fuel support consisting of a fire-clay block, carried by suitable legs or supports, and formed at its lower end with a fuel-retaining flange and with holes to accommodate the burner nozzles." The patentee says he has found that the flange on the fire-clay block is somewhat liable to fracture, and to overcome this defect, he now proposes to form the fuel-retaining flange separately and on a metal plate which is also formed with the holes to accommodate the burner nozzles—the plate being supported by brackets or ears extending from the legs or supports which carry the block, or else secured to the burner which is itself carried by the supports. The block itself may also be formed with an arched upper surface.

Pipe Connection.

ANDERSON, H. P. H., of Erith.

No. 29,212; Dec. 19, 1912.

The inventor purposes to fix a connection to pipes "without the necessity of screwing the tapping of the main pipe or other container or expanding the connection."



Anderson's Pipe Connection.

The apparatus consists of a screwed tube A into which two or more segments B are fitted, each having a large and small flange C D. The large flange overlaps the inside of the main pipe or container, while both flanges overlap the top and bottom of the tube A. The segments are held in position by a circular plain tube E, which acts as a locking key.

The apparatus is fitted to the main X by passing the screwed tube through the tapping. The segments are then put through the tube A from the outside; the large flange of the segments going to the inside of the main, and the plain tube or key pressed home. The whole is held firm in position with a washer F and back-nut G screwed up in the ordinary manner.

APPLICATIONS FOR LETTERS PATENT.

11,163.—LOXTON, W. W., "Inverted burner globes." May 13.
11,178.—ENDERLEIN, K., "Lighting device." May 13.
11,236.—SHAW, E. W., "Full-way valves." May 13.
11,241.—PERCY, W. H., "Projection of light." May 13.
11,268.—WILLOCQ, J. D. & D., REGNAULT, F. J. H., and DUCELLIER, A. J., "Generating acetylene gas." May 14.
11,297.—GARLAND, C. S., and TALBOT, H., "Packing mantles." May 14.
11,305.—HARGER, J., "Treatment of coal." May 14.
11,391.—MAGNEE, C., and DEMEURE, E., "Production of water-gas in engines." May 15.
11,444.—LIVERSEDGE, A. J., and DAVIDSON, W. B., "Washing gases." May 16.
11,450.—MOHR, B., "Recovering ammonia from products of incomplete combustion or destructive distillation." May 16.
11,513.—CONTZEN, H., "Measuring flow of fluids." May 17.
11,515.—ELTON, W. G., and CHESHAM, S., "Gas-protector and improver." May 17.

LEGAL INTELLIGENCE.

ACTION AGAINST THE SOUTH METROPOLITAN GAS COMPANY.

Last Thursday Mr. Justice Rowlatt and a Common Jury heard the case of "Smith *v.* South Metropolitan Gas Company." In this action, the plaintiff was Mr. Alfred Amos Smith, of Bexley Heath, and he sued the Company for damages for personal injuries alleged to have been caused by the negligence of the defendants' servants. The defendants denied negligence, and alleged contributory negligence on the part of the plaintiff.

Mr. SANDERSON, K.C., and Mr. DAVENPORT appeared for the plaintiff; Mr. CLAVELL SALTER, K.C., and Mr. J. B. MATTHEWS for the defendants.

Mr. SANDERSON said the accident happened on Oct. 18, 1911. Plaintiff was employed at the Thames Iron-Works, at Blackheath Hill, Greenwich, and he carried on a motor repairing business at Bexley Heath, where he lived. He earned £2 a week at the Thames Iron-Works, and made about another 15s. by his repairing business, and he had a house rent free. He was in the habit of using a motor cycle to get to and from his business. The plaintiff was returning home on the night in question, about 7 o'clock, in foggy weather. He was riding on his proper side of the road at from six to eight miles an hour, when he suddenly saw a motor lorry belonging to the defendant Company on the wrong side of the road. Before plaintiff could get out of the way, he was struck and thrown off the machine and severely injured. His knee was hurt to such an extent that after great suffering, his leg had to be amputated. It would be seen from the evidence that the defendants' driver, instead of driving on his proper side, the night being foggy and he fearing to miss the turning to Blackheath Station where he was going, kept on the wrong side of the road, which was undoubtedly the cause of the collision. The result of the accident was very unfortunate for the plaintiff, as he was now absolutely prevented from earning his living as he had done before; and if it should be established that the defendants were liable, he should ask the Jury to give the plaintiff very substantial damages.

Evidence was given on behalf of defendants that the lorry was travelling on its right side of the road, and that the plaintiff was on his wrong side.

The Jury returned a verdict for the plaintiff—damages £500.

On Friday, Mr. MATTHEWS asked for a stay of execution, with the view of giving the defendants an opportunity of considering whether, under the circumstances, they would move for a new trial. He said they were prepared to pay the costs on the usual undertaking; and, having regard to the position of the plaintiff, to pay him 15s. a week without any obligation on his part to refund if they succeeded in obtaining a new trial.

Mr. DAVENPORT objected to the stay, and said it could not possibly be suggested that there had been any miscarriage of justice.

His LORDSHIP said there was a moderately strong case for the defendants, though there might be great difficulty in upsetting the verdict. This, however, was not a matter for him.

Mr. MATTHEWS said the point to be considered was whether a man riding a motor bicycle where he could not see far in front owing to fog was justified in travelling at the rate of ten miles an hour.

His LORDSHIP entered judgment for the plaintiff for £500, but granted the stay on the terms suggested.

MOTOR-CAR TRAFFIC AND PUBLIC LIGHTING.

At the Lambeth County Court last Friday, before his Honour Judge Parry, Mr. Sidney F. Bayer, of No. 153, Oakwood Court, Kensington, brought an action against the South Metropolitan Gas Company to recover £17 13s. 3d. for damage to a motor-car at Clapham Common. There was a counter-claim against Mr. Bayer for £2 16s. 11d. for damage to a lamp-standard.

Mr. FLETCHER appeared for the plaintiff; and Mr. CHARLES represented the defendants.

Mr. *Bayer* stated that at 11.30 on the night of the 16th of July last he was driving a motor-car at the speed of about 10 miles an hour. On reaching Clapham Common, he found that the road was up for repair; and he was forced to drive on the off-side of the road, where the pathway was not properly kerbed. He passed safely three or four lighted lamps, when he dashed into the post of an unlighted one on the edge of the path. Mrs. Bayer, who was in the car, was severely shaken by the impact, and the car was damaged, necessitating a new axle.

In cross-examination, witness denied that a watchman employed by the Battersea Borough Council picked up the top of the broken lamp, and had to drop it because it was so hot.

William Henshaw, of The Cedars, Clapham Common, said that on the night in question he noticed that the lamp was out. He had not gone 20 yards when he heard the smash, and found that the motor-car had run into the post.

For the defence, *Charles Waite*, a watchman in the employ of the Battersea Borough Council, said just before eleven o'clock he passed the lamp, and it was then all right. After the accident, he picked up a part of the broken lamp; but it was so hot that he had to drop it.

Joseph Feagon, a lamplighter in the employ of the defendants, stated that he lighted the lamp on the night in question, and there was nothing the matter with it. If there had been, he would have attended to it.

In cross-examination, witness stated that some complaints had been

received that certain lights in the vicinity of Clapham Common had been turned out; but he could not say by whom.

John Nichol, a foreman lamplighter, said that at half-past nine on the night of the accident the lamp was burning properly.

Mr. CHARLES held that no negligence by the Company was proved.

His HONOUR: You cannot expect a man to be stationed under every lamp. Another car may have run into the post, and knocked the light out.

Mr. FLETCHER said it was the duty of the Company to see that every lamp was lighted. The lamp-post was practically on the highway, as the kerb of the pavement had been removed.

His HONOUR said there was no evidence of negligence. He was satisfied that the system of inspection adopted by the Company was an excellent one, and that the lamp was alight a few minutes before the accident. It was possible for one of the public to have turned out the light. He gave judgment for the defendants on the claim, and for the plaintiff on the counter-claim—costs to follow in the usual way.

TICEHURST AND DISTRICT WATER AND GAS COMPANY.

Last Thursday, a summons came before Mr. Justice Eve, in the Chancery Division of the High Court of Justice, in an action of Locke *v.* The Company, to obtain the confirmation by the Court of a conditional contract which had been entered into for the sale of part of the Company's works to Mr. John Luke Venables, J.P., of Wadhurst.

Mr. A. B. MARTEN appeared to support the summons, and suggested that it ought to be heard in Chambers.

His LORDSHIP did not consider this could rightly be done after the recent decision of the House of Lords. He had looked through the contract, and thought it should be confirmed, subject to surety being given.

Mr. MARTEN pointed out that in a contract for £10,000, Mr. Justice Joyce had ordered surety for £2000 to be given.

His LORDSHIP said in this case £1500 would be sufficient.

Mr. MARTEN suggested that possibly the bond might be approved by the Master in Chambers. There was liberty given to the purchaser to attend the proceedings; and he submitted to the jurisdiction of the Court. In the previous case, liberty was given to the plaintiff to pay the costs of the Company, and to add them to his own; and he (the learned Counsel) would suggest that the same direction should now be given.

His LORDSHIP assented.

Action as to Robinlyte Patent Profits.

In the King's Bench Division of the High Court of Justice last Tuesday, Mr. Justice Phillimore tried, without a jury, an action brought by Mr. Charles Frederick Killar against Mr. Jacob Ignot Robin to recover money under an agreement made in December, 1910, in regard to sharing in the profits of certain gas-mantle patents. The case for the plaintiff was that in 1909 Mr. Robin was the Managing-Director of the Robin Gas-Mantle Company, Limited. Money was required for the concern, and Mr. Killar introduced Mr. Robin to parties who found it. In consideration of these introductions, Mr. Robin gave to one of the gentlemen concerned a commission note under which he was to receive certain moneys and a number of shares out of those which Mr. Robin was to have. Mr. Robin had in the meantime invented the Robin mantle, and a Syndicate called the "C. and G. Syndicate" came into existence to acquire the patent rights. The defence was that the commission referred to was only due to the plaintiff in the event of a sale to the Syndicate being completed. It was after litigation between Mr. Robin and the Syndicate had commenced that the agreement was made which provided that the plaintiff should have one-tenth of all moneys and shares the inventor should receive or purchase-money for the patents, after the liabilities of the Robin works were satisfied. His Lordship said there was a counter-claim by the defendant for the rectification of the contract. The plaintiff had proved that in 1912 the patents had been sold for a considerable amount of shares, and, in his judgment, the plaintiff had established his claim to one-tenth. There would have to be an inquiry as to what was due. He granted a declaration to this effect, with an order for an inquiry; and he gave the plaintiff the costs of the claim and the counter-claim.

Carlow Gas Company.—Mr. Joseph C. Deighton, the Chairman, presided at the annual meeting of this Company, when it was stated that the net profits were £979, or equivalent to something more than 18 per cent.; and that to this had to be added interest on investments, equal to nearly 3½ per cent. The paid-up capital was stated to be £5210; and the amount invested, written-down to market price, was £5080. The report was adopted, and a dividend was declared at the rate of 6 per cent., free of income-tax.

The "Discs for Coin" Proposal Again.—Writing to the Press, Mr. J. F. M'Kenna, J.P., of Belfast, suggests that the penny-in-the-slot gas-meter is a great temptation to children "in the way of raising money," and, therefore, adds to theft. He says he has been much struck by the number of young boys brought up at the Children's Court charged with breaking open this form of meter and abstracting the contents. He thinks the Corporation Gas Department should get discs made of metal of the same size and shape as a penny, properly stamped and numbered, and circulate them to users of the meters through Corporation offices, or have them stocked by shopkeepers who could be allowed a small discount. When supplying the meters, a clause could be inserted in the agreement to the effect that only these discs should be used for the purpose of obtaining gas. They might be sold in packets of a dozen, at, of course, the value of 1d. each.

MISCELLANEOUS NEWS.

GAS VERSUS ELECTRICITY IN THE HOME.

Some Facts for East Ham Ratepayers—and Others.

There was a lecture delivered in the Municipal Buildings at East Ham last Wednesday evening which was well worthy of consideration by a larger audience than that which assembled to hear it; and therefore it is satisfactory to find that a very full report of the proceedings has been published in the Local Press. The lecturer was Mr. H. H. Creasey, of the Gaslight and Coke Company; and the occasion was a meeting of the East Ham Ratepayers' and Burgesses' Association. The subject dealt with was "Gas *v.* Electricity in the Home;" and those who know Mr. Creasey and his work do not need to be told that he is able to speak with authority on this matter, and on the merits of gas generally.

In the first place, Mr. Creasey set out to show the accuracy of his contention that by using gas his audience would not only be purchasing the best article at the lowest price, but would incidentally be assisting themselves, their fellow-ratepayers, and, in fact, the whole borough. The electricity supply departments of borough councils, he said, always claimed that the ratepayers should use electricity, because the more they did so the greater would the profit be, and down would go the rates. But did the rates go down? Apparently the argument was that if the ratepayers would use electricity, and pay from two to eight times the amount they would for gas (according to the purpose for which it was employed), they might if lucky get a penny in the pound knocked off the rates. Assuming a household account was heavier in current and upkeep by only £2 per annum, owing to the use of electricity instead of gas, how far would a problematical penny in the pound off the rates go to balance this extra outlay? Another thing that had to be remembered was that the benefits of this penny in the pound—if it ever did come off—would be shared by those people who were wise enough to use gas, and to let those who were willing pay the extra amount necessary when consuming electricity. If the penny came off the rates, these gas consumers would accept it with delight, as they would not have paid many times its value to get it.

A "HOME INDUSTRY."

There is, of course, another aspect of the question; and this also was pointed out by the lecturer, who submitted that the continued and increased prosperity of the Gaslight and Coke Company was of at least as great importance to East Ham as the prosperity of the borough electricity supply. In other words, the first thing the ratepayers should think of doing was to help to extend the business of the Company, and certainly not injure it in any way. Nearly 1500 of the Company's employees live in East Ham; and every one of them contributes directly or indirectly to the rates. Then, the rateable value of the Company's property in the borough is just under £21,000, or about 4 per cent. of the total rateable value of the borough; and they pay to East Ham over £10,000 per annum in rates. Those present were invited to compare this with the number of men employed by the Borough Council in generating and supplying electric current—probably less than fifty—and the amount of money (if any) paid by the electricity undertaking to the borough in the shape of rates. He added that, in addition to whatever small sum was paid in rates during the year ended March, 1912, the East Ham electrical concern was computed to have made a profit of £1954—which sum, however, was less than enough to reduce the rates by a penny in the pound. This return was from a matured undertaking in its eleventh year of working.

Before quoting a concrete example, Mr. Creasey said that profits which were credited to the supply of electricity by borough councils were mostly dissipated in the extra cost of lighting their own institutions. That was to say, if a borough institution could be re-lighted by gas at an initial cost of (say) £155, the electricity department would plead for the custom, and electricity would be installed at a cost of (say) £425. If then a small profit was made on the sale of electricity, it would be pointed to with pride—the fact being ignored that electricity had cost £270 more to instal, and that the institutions cost twice or three times as much per annum for current and maintenance as would have been the case with gas. The figures just given were the actual ones quoted by his Company and the Borough Electricity Department for re-lighting the Central Park Schools. Bearing in mind all he had said, his Company claimed that if sympathy with a family concern or a "home industry" had, or should have, any bearing on the question of whether or not the ratepayers should support them, their case was so strong that they were assured of such support. However, for their success in business the Company did not depend, never had depended, and trusted they never would have to depend, upon anything other than the fact that the commodity they sold was better from nearly every point of view than that supplied by their competitors.

In connection with the latter assertion, Mr. Creasey proceeded to make a short comparison of gas and electricity in the matters of reliability, cost and advantages in use, cost of upkeep, and hygiene. On the point of reliability, he said, gas scored heavily; and it would need something like an earthquake to cause a cessation of the supply of gas to any portion of London. On the other hand, the supply of electricity, after many years of practice and experience, was still notoriously unreliable. Instances were quoted to show that electricity could not be solely relied upon, and that when it was used gas should be present as a stand-by. Had anyone, he asked, ever heard of it being necessary to instal electricity as a stand-by, in case the gas failed?

COST AND ADVANTAGES IN USE.

Next as to cost, and advantages in use. As regarded the cost of piping or wiring, electricity was at a disadvantage. Then there was the slot-meter system of gas supply, with complete installations; and

nowhere had such a system proved a profitable enterprise to electrical undertakings. After the piping or wiring was done, the cost of the purchase and fixing of fittings for gas or electricity for lighting purposes was certainly in favour of gas; and a good inverted gas-burner, which could be bought for 3s., would give an equal light to two or three electric lamps of the candle power frequently installed, thus again reducing the cost of installation. His Company's charge for supplying, fixing, and maintaining a 1000-candle power shop gas-lamp, including the cost of gas for 1000 hours per annum, was £6 15s. Compare this with a 1000-candle power electric lamp, under the same conditions, for a similar number of hours, which cost in East Ham £9 7s. 10d.; and once again the unanimous decision must be in favour of gas. The East Ham Electricity Department, in a leaflet they issued, stated that 1d. would supply electricity for nine hours, with an Osram lamp giving 25-candle power. Taking these figures for their purposes that night as correct, they might be compared with a small inverted gas-burner, which was reputed by the manufacturers to give 30-candle power and to consume 1 cubic foot of gas per hour. To allow a safety margin, he would take it the burner, as an average throughout the life of the mantle, gave only 25-candle power, and consumed 1¼ cubic feet per hour. The Company gave 33⅓ cubic feet of gas for 1d.; and on this basis they arrived at 26⅔ hours lighting by gas, as against 9 hours by electricity, for 1d.—making electricity about three times the price of gas. When comparing lamps of higher candle powers, the same ratio applied. Electricity at 3½d. per unit with metallic filament lamps cost, light for light, about three times as much as gas at 2s. 6d. per 1000 cubic feet. With gas at high pressure, the difference in its favour was, of course, far greater.

Another point which gas scored for lighting, the lecturer said, was the agreement of the medical profession that electricity was more injurious to the eyes than gas-light. This should be seriously borne in mind when the lighting of schools was under consideration, as it was advisable that any source of illumination which was in any way suspect as regarded possible injury to the eyes should be the last to be used in such cases. Then there was no longer any truth in an argument constantly used by electricians that electricity was far more convenient in use than gas; for there were now perfectly reliable systems of switches employed with gas fittings and lamps. A gas-switch was more, not less, convenient than an electric switch. If, as occasionally happened, an electric switch went wrong, the average householder (certainly, if a lady) could not be expected to do anything with it until it was repaired; but if a gas-switch got out of order, all that was necessary was to walk to the burner and light it with a match.

Heating and Cooking.

Coming to the question of heating, Mr. Creasey pointed out that the cost of gas fires and heaters was without question far and away less than that of electric radiators. An excellent gas-fire could be hired at from 3s. to 6s. per annum; whereas in East Ham it was not possible to hire an electric radiator, and to buy quite a modest one as regarded heating capacity would cost about 55s. As to the relative cost of gas and current, it was safe to say that, for an equal amount of heat at the ruling prices in East Ham, electricity at 2d. per unit would cost about eight times as much as gas. After giving calculations to prove this, he added that when a gas-stove was connected with a chimney there was lost, or rather used for ventilation, about 25 per cent. of its heating value; and in this case the cost of electricity was more than six times as much as gas. A good gas-fire now could be used at a cost of from ½d. to 1½d. per hour, according to size. If current for heating were to be reduced in East Ham to 1d. per unit, electricity would still be hopelessly out of it. Even if the current were given free of charge, it was not within the realms of possibility for electricity ever, under any circumstances, to provide them with a living, flaming fire in the grate, as could be done by means of gas at an extremely low cost. When they came to consider cooking, everything again was in favour of gas. A gas cooking-stove, with an oven and several burners on top, could be hired for 1s. and upwards per quarter, or purchased as cheaply as 33s. Electric cooking-stoves could not be hired in East Ham; but one of scarcely equal capacity to the gas-cooker just referred to would cost about £10 to buy. The expense for current would be in the same ratio to gas as when used for heating purposes. It was argued that, by cooking with electricity there would be much less loss in the weight of the meat, owing to it being cooked in a closed and practically unventilated oven; but what the electricians feared was loss of heat, not loss of meat. If joints of meat of similar weight were cooked equally slowly in gas or electric ovens, the weight of the cooked meat in the two cases would be the same. If, however, an externally heated or closed oven were required, the gas people could provide it; and he had successfully done so at the Langham Hotel, and had just arranged a similar installation for Saddlers' Hall, Cheapside.

The Cost of Upkeep.

Maintenance was the next point dealt with; it being remarked that, for a total inclusive charge of 1s. 4d. to 2s. 4d. per burner per annum, according to the circumstances and frequency of inspection, the Gas Company maintained all incandescent burners, and replaced the mantles when necessary. Electrical undertakings could not do this; and if they could not, it was certain the consumers could not either. He thought they would agree that the general maintenance or upkeep of electric lamps was at least twice as costly as that of an equal number of gas-burners giving a larger candle power. The cost of maintenance of electric cooking appliances was also far greater than was the case with gas. Very few electricity suppliers hired-out electric cookers; but one borough council who had recently started doing so charged a rent of £2 2s. for a year or part of a year. The range might be purchased during the first year of hire for an additional payment of £10 10s. While on hire, maintenance was, of course, free; but if purchased, the range would be maintained at a charge of 5s. per quarter. Against this, a gas-cooker of the same or greater power could be hired and maintained for 8s. per annum, or one-fifth the charge for the electric cooker. A gas-cooker of this kind could be purchased for about £3 15s., or one-third the cost of the electric cooker, and, if purchased, would be maintained by the Gas Company for a couple of shillings, instead of a pound, a year. A cheap electric kettle would cost about 27s., or until a few months ago could be hired from one electric supply corporation for 10s. per annum. This gave a shrewd idea of its life and the cost of renewals, and could be compared with a gas-ring costing 1s. to 1s. 6d. (with no outlay for renewals) and an inexpensive kettle. With the electric iron it was much the same. One corporation until recently hired out at 8s. per annum irons of this kind costing 10s. 6d.; whereas a good gas-iron could be obtained for 5s. or 6s., and cost nothing for renewals. As the authority he had in mind had ceased to hire-out the articles named, it was evident that, even at the extraordinarily high figures mentioned, the cost of renewals was so great that they had to give up the practice. As regarded heating, an electric radiator costing from £2 10s. to £3 would probably run into about 15s. per annum for renewals, if used to any extent, or if it was desired to keep it within a reasonable percentage of its original efficiency. A gas-fire of far greater power, even allowing for the loss of heat owing to it assisting the ventilation of the room, would cost from 16s. 6d. to 30s. to purchase, and could be overhauled once a year under the Company's stove maintenance system for 1s., and perhaps a few pence for new fuel. If hired, the total cost per annum would be 3s., including renewals.

From the Point of View of Hygiene.

Proceeding, the lecturer considered the question from the point of view of hygiene. If the use of gas were not hygienic, he said, one would expect that any material increase in its output would detrimentally affect the general health of the public. The truth was, of course, that, taking (say) the last twenty years, the death-rate had been very materially reduced, and the public health had improved. Yet in the period from 1891 to 1911, the number of gas heating, cooking, and hot-water appliances sold and hired by Metropolitan and Suburban Gas Companies had increased from 46,000 to 1,494,000. In the same time, the output of gas by these companies had risen from 34,500 million cubic feet per annum to 56,053 millions. He felt confident that a good deal of the credit for the improvement that had taken place in the public health might be put down to the hygienic and labour-saving qualities of gas. Eminent scientists had proved that gas lighting was more hygienic than electric lighting, owing to its ventilating and germ-destroying effects. As to the effect of gas on ceilings, with modern incandescent burners, especially those of the inverted type, the blackening process was a very slow one, and whitewashing the ceiling was no more frequently necessary than was essential if cleanliness and hygiene were to be considered.

His Company had recently re-fitted the Victoria Park Chest Hospital with gas lighting; and if gas was sufficiently hygienic for use in a hospital for consumption, it certainly was so for any other place. There were more than 2800 medical men known to be using, and to be satisfied with, gas-fires in the part of London which his Company supplied. This represented over 67 per cent. of the total number of doctors in their area. He could show hundreds of testimonials from doctors as to the convenience, efficiency, and healthfulness of gas heating; many of them remarking that gas-fires were specially good for use in bedrooms or sick rooms where the most steady, regular, healthful, dustless, and noiseless form of heating with ventilation was required. Gas-fires were in use in large numbers of dispensaries for the prevention of tuberculosis, hospitals, &c.; and the Company had recently fixed them in the Royal Institute of Public Health. He had received instructions from the Borough Medical Officer of Health to fix a number of gas-heating stoves in the Leyton Isolation Hospital. Some of these were in the diphtheria and scarlet fever wards—taking the place of electric radiators supplied with current by the Borough Council. Gas-fires gave radiant heat, and materially assisted the ventilation of a room; whereas electric radiators were not, and never could be, efficient ventilators. Dr. Leonard Hill, Lecturer on Physiology at the London Hospital Medical School, was, with many other scientists, a believer in the open chimney and radiant heat, and was satisfied that gas-fires efficiently provided this form of heat, without the dust, dirt, and labour connected with a coal-fire. A lecturer on hygiene at the Charing Cross Medical School, having had gas-fires fixed at his residence and made personal observations and tests of the air, was so satisfied that modern gas-fires were perfectly hygienic that he had them installed at the Medical School for the purpose of lecturing and demonstrating on ventilation and radiant heat.

With reference to cooking, hundreds of doctors used gas for this. There were 114 hospitals in the portion of London supplied by his Company, and 85, or about 75 per cent., of these used gas for cooking—many of them having a gas cooking-stove in every ward kitchen.

After touching upon the use of gas for water heating, and some other points, Mr. Creasey concluded by saying that several important firms in that neighbourhood connected with the electrical industry were very large users of gas. Thus, in spite of their rivalry with electricity, the Gas Company were on friendly business terms with many connected with it. He had made no statement in his address that was not founded on fact, and capable of proof. It was the desire of his Company that everyone connected with it—officers and workmen alike—should make no other than truthful statements, as no business could succeed that was not founded on the satisfaction and confidence of its customers.

Some Candid Criticism.

The Chairman (Mr. J. A. Williams) remarked that they had had an excellent address, and Mr. Creasey had given them much food for thought. As most of those present were aware, a discussion had been going on in the Education Committee as to the possibility of installing electric light in place of gas at one of the schools; but the lecture was in no sense a sequel to this. It had been arranged long before.

After one or two questions had been asked and answered,

Mr. H. Barfield moved a vote of thanks to Mr. Creasey, and said that, so far as the schools were concerned, it stood to reason that it would be much cheaper to go in for good gas-fittings than run a cable a long distance to instal electric light.

In seconding, Mr. Cattermole expressed the opinion that the lecture was an able exposition on behalf of gas.

The resolution was carried, and acknowledged by Mr. Creasey.

Councillor Cashman stated that he had electric light in his own house,

but one night went home and found it had failed, and his son was using some acetylene lamps from the bicycles. He (the speaker) caused a gas-bracket to be placed in the scullery, and subsequently discovered his wife threading a needle out there—she remarking that it was the only good light they had got. (Laughter.) Mr. Creasey had told them that a flat-flame burner ought not to exist in any school in East Ham; but there were seventeen of them where they were in use. ("Shame.") Quite recently a head mistress informed him that she had to leave off a lesson at about three o'clock in the afternoon, and start the children on something for which the light was not required; and yet, notwithstanding facts and figures, twelve out of sixteen of the members of the Education Committee voted against the introduction of inverted burners. A man who was elected to watch over the interests of the ratepayers and their money, and who spent the money as recklessly as this, was belying the trust of the people; and the people ought to realize it. The Central Park Road School was to be installed with electric light at a cost of £425, while the scheme of the Gas Company came to only £155—another firm submitting a quotation to equip Shaftesbury Road School for about £70. They had, however, got a few people who would spend money at any cost, simply because it was public money.

Mr. Fletcher supported Councillor Cashman in the attitude he took up. He said he had been to Shaftesbury Road, and seen the inverted burners in use; and the light was remarkably effective. If electric light was installed in all these schools, it would mean a capital expenditure of £8000. Borrowing the money to pay for this at 4 per cent. would cost £320 annually in interest; while he understood the revenue would, at the outside, be only £300. So that they were going to lose £20 a year for the pleasure of satisfying the Electric Lighting Committee. They should rouse public opinion on the matter. This was an instance where the Ratepayers' Association and the Municipal Alliance could work together for the benefit of all, and do everything possible to see that the whole thing was thoroughly threshed out.

Mr. Thomas said Councillor Cashman had disclosed what he believed to be a very great scandal. They ought to express their feelings by passing a vote of censure upon the Council for deciding to embark upon such an extravagant and unbusinesslike scheme. If the Chairman allowed him, he would move this.

Mr. Pope, however, pointed out that so far they had not heard a single reason given by the opposite side; and this being so, to pass a resolution of the character indicated might make them look extremely foolish.

Councillor Cashman thought there should be a meeting, at which they should invite the members of the Council to defend their action.

Mr. Cattermole proposed that they should send a resolution to the Council stating that it was the opinion of the meeting that the best interests of the ratepayers would be served by not proceeding with the electric lighting of any of the schools, and that the present gas lighting was out of date, and should be remodelled as soon as possible.

This was agreed to with one dissentient.

The Chairman then intimated that the Secretary would communicate with the Municipal Alliance regarding the suggestion for a joint meeting in the Town Hall.

BIRMINGHAM CORPORATION GAS AND WATER SUPPLY.

Working of the Gas Department.

At the Meeting of the Birmingham City Council last Tuesday—the LORD MAYOR (Lieut.-Col. Martineau) in the chair—the progress of the gas and water undertakings of the Corporation in the past financial year was under consideration.

Alderman Sir HALLEWELL ROGERS brought up the report of the Gas Committee, noticed in the "JOURNAL" last week (p. 542), and, in moving its adoption, said he thought that, on the whole, the Council and the ratepayers would be gratified with the result of the year's working of the Corporation trading departments. It must be distinctly understood that it was absolutely necessary the trading departments should be worked on sound commercial lines, and that no profit was paid over in reduction of the rates that had not been legitimately earned. The results of the trading departments must necessarily fluctuate, owing to the higher prices of raw materials and any increase the Council thought fit to make in workmen's wages. This especially affected the Gas Department, which was more dependent on the price of raw materials, in the shape of coal and gas oil, than the other trading departments. Consequently, there must be a greater fluctuation in their earning power if the present policy were continued—a policy which the Committee thought was the right one—of charging only a very reasonable price for gas. It was inevitable in a large city like Birmingham, he supposed, that the rates should go up from time to time; but those ratepayers who used gas for lighting, cooking, and heating, and who also rode in tramcars, benefited by the reductions in the price of gas and in tram fares, which in many instances during the last three years had exceeded the increase in the rates. He had ten or twelve practical examples of this in respect of houses rated at from £12 to £30 a year inside the old city. Since 1910, the rates had risen 9d. in the pound; but with the reduction in the price of gas, which was actually ascertained, and assuming that one member of the family rode in tramcars to Birmingham and back once a day, there was a saving of from 18s. 1d. to £2 8s. 11d. in the year over and above the increase of 9d. in the pound in the rates. This, of course, might be applied to the large manufacturers of the city also; and he was fully convinced that they, by the reduction in the price of gas, had more than saved any increase in their rates. The net cash balance of profit from the Gas Department was £77,725, against £80,681 last year—a decrease of £2956. It must be borne in mind, however, that the assessments of the gas-works and mains were increased in September last by £20,000, and therefore the department contributed to the rates for the second half of the year £4500 more than they would have paid if the assessments had not been disturbed; while the increase in workmen's wages, granted by the Council in February last, represented something like £10,000 a year. In addition, the year's trading included practically the whole of the cost of the coal strike, which meant not only the curtailment of the output, but also serious increases in the cost of coal, for at the time of the strike they had to purchase coal at very high prices. The year, too, had borne the full results of the reduction in the price of gas granted in January, 1912—a reduction which was equal to giving consumers upwards of £70,000. The result of the working of the Gas Department for the last three years showed that they had paid in cash to the rates £243,610, that they had reduced the prices to consumers to an extent equal to 16 per cent. (say, £130,000), and that there was an allowance on behalf of public lighting over this period of £32,898. So that altogether the department had contributed directly or indirectly to the ratepayers in the three years no less than £400,000, while the outstanding debt during the same period had been reduced by £122,411. The increased consumption of gas in the past year was 8½ per cent. compared with the previous year. This constituted a record; the increase being almost sufficient to supply the whole of the town of Wolverhampton for twelve months. By the extended use of gas for cooking, the great difference between the winter and summer consumption would be lessened; and he was glad of this, because the present methods had led to a suspension of a great deal of labour in the summer. On the occasion of the previous coal strike in 1893, it was found necessary, having regard to the increased expenditure, to raise the price of gas by 3d. per 1000 cubic feet; but the Committee did not think they would have to do this now, though, owing to the large increase in the cost of all materials, the outlook for the next twelve months could hardly be considered as satisfactory as usual. While the output of gas continued to increase (and this represented increased income), the other factors he had mentioned more than wiped out the increase. The department had to consider the market for their residual products. This had been particularly strong during the last twelve months; and if it went back materially, it was difficult to see how this year's profits, which he regarded as the high-water mark, could be fully maintained. As an experiment, the Committee had centrally hung high-pressure gas-lamps in Paradise Street. The position was really chosen because Victoria Square and Paradise Street were the only places in the city where the lighting was directly controlled by the Gas Department. When the Corporation acquired the undertakings of the Gas Companies, Mr. Joseph Chamberlain wisely kept the area of Victoria Square and Paradise Street for experimental purposes by the Gas Department; aud the lighting of the square did not fall on the rates, but on the department. Whether or not Paradise Street was the ideal place for high-pressure lighting remained to be seen. In conclusion, Sir Hallewell Rogers said that, notwithstanding the drawbacks to which the Department were subjected, he thought the results of the year's working were eminently satisfactory.

The motion having been seconded,

Mr. MARKS congratulated the department on their report, and particularly on the sales of the residual products, with the exception of ammoniacal liquor, the increase of which was proportionally less than in the case of coke and tar. He asked whether the Committee could not advantageously consider the question of working-up the liquor into ammoniacal products, which could be readily made from it by the department.

Mr. HARRISON BARROW inquired whether the Committee had considered the desirability of using a "Metropolitan" No. 2 argand burner for testing the illuminating power of the gas. He said he believed the adoption of this burner would result in a saving to the department of several thousand pounds per annum.

Sir HALLEWELL ROGERS, in reply, said the question had engaged the attention of the Committee for some time. They were now testing the gas with a burner which was quite out of date; and the Committee were thinking they would have to come to the Council and ask for sanction to use the No. 2 burner. With regard to the question put by Mr. Marks, he said the prices of ammoniacal liquor had been less during the past year, and were still going down. The department sold the liquor to works in the neighbourhood, and it was delivered in pipes. It would be for the Committee to consider whether it would be wise to work-up the liquor themselves.

The report was approved.

Progress of the Water Department.

Alderman LLOYD then presented the report of the Water Committee, and proposed its adoption. He said the water-rental showed an increase of £6406, or just over 2 per cent. The domestic rental had increased more than 3 per cent.; but the measured supplies showed an advance of only 1·16 per cent., against more than 7 per cent. a year ago, notwithstanding the fact that trade had been good. The actual trade supplies were £2600 better; but there was a reduction of £1500 in the quantity of water supplied for railways and road watering. The expenditure had been heavy—showing nearly £8000 increase. Rates were £1000 more, the cost of labour was £1300 more, and the cost of pumping, owing to the rise in the price of coal, was £500 higher. The Coventry supply had cost £1000 more, including the amount for the reconstruction of filters; the office alterations cost £2400; the half-year's rent and extra cost came to £1500; and burst mains at Selly Oak, Harborne Hill, and Salford Bridge had entailed an outlay of £750. The summer of last year was wet, following a very dry one; and neither year, therefore, could be considered normal. If the two years were taken together, the consumption of water was equal to an increase of 4½ per cent. compound. The average daily consumption last year was 22·4 million gallons per day, or 100,000 tons of water delivered to the district daily. This naturally led up to a question which had been referred to from time to time—viz., the date at which it would be necessary to lay a third pipe from Wales. This question had the attention of the Committees annually; and as it was a complex matter to decide exactly what provision must be made for the summer months four years ahead—particularly with regard to the extent to which, and the best manner by which, the stand-by supplies could be most profitably utilized—the Committee had submitted the problem to an expert, but had not yet received his report. For a fortnight, about 46 per cent. of the water used was drawn from the old sources of supply. The Elan Valley works and aqueduct were now reported to be in good condition.

In view of the financial aspect of the undertaking, the Council would be interested to know that during the year ended March 31, 1907 (the first complete year of the supply of Welsh water), an average price of 9½d. per 1000 gallons was received from the unmeasured supplies—viz., the domestic, fire, and waste. On account of the gradually increasing amount of water used per head per day, the price had fallen to a little more than 8½d. for last year. This was no doubt a source of satisfaction to the Medical Officer of Health and the Health Committee, but it was very expensive to the Water Department. Putting it another way, the quantity of water supplied for 1d. in the earlier year was 104 gallons; but it was now 114 gallons, or practically a rise of 10 per cent. in six years. In other words, the Corporation delivered for 1d. half-a-ton of water under sufficient pressure to fill the cisterns at the tops of the houses and afford protection against fire. This 10 per cent. more water given without any increase in price would, if paid for, raise the revenue of the department by no less than £22,000 a year.

The motion was carried.

COVENTRY GAS-WORKS RESULTS.

Substantial profits have again been earned during the past twelve months by the gas undertaking at Coventry; the results of the trading for the year ended March 31 being very satisfactory.

The total borrowing powers since the acquisition of the undertaking amount, with nominal additions, to £479,805, of which £32,030 has been repaid out of the sinking fund, and £47 temporarily repaid, leaving the present liabilities £447,728. Against these liabilities, the Corporation have reserve and sinking funds amounting to £89,225, leaving a balance of liability of £358,503. The total capital expenditure since the acquisition of the undertaking has been £483,492; but £48,000 has already been set aside towards meeting the loss of capital consequent upon the abandonment of plant at the old works—thus reducing the actual expenditure to £435,492. The revenue for the year from all sources, including sales of gas, coke, tar, and other products, amounted to £166,456, and the working expenses to £124,629—leaving a gross profit of £41,827, compared with £45,438 for the previous year. After meeting capital and other charges, the surplus available is £20,361, against £24,554. The Committee are recommending this sum be dealt with as follows: £5000 to be paid over to the general district fund in aid of the rates; £10,000 to be set aside towards meeting the loss of capital consequent upon the abandonment of plant at the old works; £5000 to be placed to the reserve fund; and the balance of £361 to be carried forward.

STAFFORD GAS AND ELECTRICITY SUPPLY.

The Past Year's Working.

The Chairman of the Gas and Electricity Committee of the Stafford Corporation (Mr. C. H. Wright) has presented his report for the year ended the 31st of March. It is accompanied by the accounts of the two departments under the Committee's control, which are signed by the Engineer and Manager (Mr. W. M. Valon).

Dealing first with gas, Mr. Wright says it is gratifying to be able to report that 231,221,000 cubic feet were sent from the works in the past financial year, compared with 218,813,000 cubic feet in 1911-12 – being an increase of 12,408,000 cubic feet, or 5·67 per cent. This forms a record for the gas undertaking since it was acquired by the Corporation; and, added to the increase of 16,377,000 cubic feet during the previous two years, gives a total of 28,785,000 cubic feet for three years, which is by far the largest increase obtained in any similar period. The unaccounted-for gas amounted to 2,969,015 cubic feet; being only 1·28 per cent., against 1·59 per cent. before—again maintaining the Corporation's record for the lowest leakage account of any undertaking in the country.

The sale of gas produced £25,629; being an increase of only £173, although more than 12 million cubic feet extra were sold. But this was due to the fact that the price of gas was reduced 2d. per 1000 cubic feet, which entailed a loss of £1100. Coal cost £13,487, compared with £10,539—an increase of £2948; but residuals returned an increased revenue of £2467. The extra net cost for coal was consequently £481. The extra cost of coal works out at about 1s. 2d. per ton for the year. This is regarded as a very satisfactory figure, considering that the average increase for the country is more than 2s. per ton; but Mr. Wright points out that there will be a further increase of 1s. 6d. for the current year.

The total revenue was £37,633, and the total expenditure £25,967; leaving a gross profit of £11,666. After deducting charges against the net revenue account, there is an available balance of £6437, compared with £9050 last year. It is explained that this apparently large decrease is due to the heavy expenditure during the year on repairs of district mains, meters, &c., and also to the fact that £500 was included in the revenue account for the first time as the proportion of salaries in the Town Clerk's and Borough Treasurer's offices. These extra charges amount to £2782; and if, in addition, there is taken into account the £1100 decrease in the revenue due to the 2d. per 1000 cubic feet reduction in price it will be seen that there is in reality an increase of £1000 in comparison with last year.

The Committee recommend that the available balance should be dealt with as follows: That £3350 should be handed over to the district fund, which will make the contribution £3850, or £350 more than last year; that £50 should be handed to the Free Library Committee; and that the balance, after payment of the usual bonus to workmen, should be carried forward to next year's account. Adding this year's contribution to the rates, they will have benefited out of the profits of the gas undertaking by no less than £66,175.

Turning to the Electricity Department, Mr. Wright says that 731,874 Board of Trade units were sold last year, which is equal to an increase of 24·6 per cent. Of this quantity, 166,749 units were sold for lighting purposes, 542,358 units for power, and 22,767 units were used for the public lamps. During the year, 32 additional motors were connected to the mains—being equal to 349 H.P. The revenue amounted to £6182, and the expenditure was £3702, leaving a gross profit of £2480, compared with £2809 before. The total charges against the net revenue account amounted to £2267; leaving a net profit of £212. To this there must be added the amount brought forward, and rents; leaving an available balance of £407. The Committee propose to transfer £200 to the depreciation account; and, after deducting the bonus, to carry forward the balance.

The analyses prepared by Mr. Valon show that the capital invested in the gas undertaking is £34,066, or at the rate of £1 11s. 6d. per ton of coal, and 3s. per 1000 cubic feet of gas sold. The gas made per ton of coal last year was 10,607 cubic feet, of which 10,430 cubic feet were sold, or 97·47 per cent. of the output. The net profit, with the addition of the balance from last year, was equal to 5s. 11·509d. per ton of coal carbonized, and 6·856d. per 1000 cubic feet of gas sold. The amount expended on the electricity undertaking at the close of the financial year was £18,878, or at the rate of £19 of capital outlay per kilowatt capacity. The profit on the year's working was at the rate of 0·07d. per unit sold.

LANCASTER CORPORATION GAS UNDERTAKING.

Annual Report of the Engineer and Manager.

The Gas Engineer and Manager of the Lancaster Corporation (Mr. Charles Armitage, Assoc.M.Inst.C.E.) has submitted to the Gas Committee his report on the working of the Gas Department for the year ended March 31. It shows that the total receipts, including bank interest, came to £33,998, and the expenditure was £20,507; leaving a gross profit of £13,491. Out of this sum, £3085 was paid for interest on stock and mortgages; £2084 was added to the redemption fund; £6000 was contributed to the borough fund in aid of rates; and the balance—viz., £2322—has been carried to the reserve fund, making it £13,915. Of this sum £10,000 has been transferred to a working balance account, as now required by the Government Auditors.

The total sales of gas, exclusive of that supplied to the public lamps, came to £20,054—an advance of £339, principally due to the increased consumption by motive power and prepayment consumers. Residuals realized £11,750, equal to 97·54 per cent. of the cost of coal. The average price received per 1000 cubic feet of gas sold was 1s. 11·46d. The total cost of coal was £11,996—an average of 11s. 8 53d. per ton, against 11s. 3·35d. the preceding year. The gas unaccounted for was 0·79 per cent. Mr. Armitage points out that the net cost of gas—viz., 7·91d. per 1000 cubic feet sold—the returns for residuals, and the unaccounted-for gas compare very favourably with other gas undertakings.

MARYPORT GAS UNDERTAKING.

A Successful Year—Reduction of Price Foreshadowed.

From the annual statement of accounts of the gas undertaking of the Maryport Urban District Council it appears that the past year was a very successful one; the income amounting to £8116, *plus* an additional quarter's rental of £898, which is included as quite within the year's work—all the expenses incidental to the quarter's production of gas being included. The expenditure amounted to £7737; thus leaving a profit of £1277, compared with £418 for the preceding year. The gas sold through ordinary meters shows an increased revenue of £1139, and through prepayment meters of £31. The sales of residuals, &c., were higher to the extent of £666. The manufacture of gas cost £831 more than before; £728 of which amount is accounted for by the additional cost of coal—the quantity used being £259 tons, at an increased price of 2s. per ton. Wages increased by £97. Last year £200 was carried to the reserve fund, and a balance of £218 to the district fund account. In view of the expenditure on regenerative retorts, which are to be paid for out of two years' revenue, a transfer of £1100 has been made to the reserve fund, increasing it to £1508, and a sum of £177 is to be carried to the credit of the district fund account.

At the meeting of the Council on Monday last week, Mr. Hardy, the Chairman of the Gas Committee, referred to the satisfactory working in the past year, and foreshadowed a reduction of 4d. per 1000 cubic feet on the present price of gas—viz., 3s. 4d.

BURTON GAS AND ELECTRICITY UNDERTAKINGS.

Inspection of the Works.

On the invitation of Alderman Lowe, the Chairman of the Gas and Electricity Committee of the Burton-upon-Trent Corporation, the members of the Town Council and several influential ratepayers paid a visit to the gas and electricity works, more particularly to inspect the new plant which has been erected at the latter at a cost of £20,000.

The party assembled at the electricity generating station, where they were received by Alderman Lowe and the Electricity Engineer (Mr. T. Hall). Each visitor was provided with a guide-book, furnishing a concise history of the department, and giving a description of the extensions. The works were commenced under the management of the late Mr. F. L. Ramsden, who in 1903 relinquished control of the undertaking, and was succeeded by Mr. P. J. Pringle. When the works were opened in 1894, the plant consisted of 80 kilowatt rope-driven alternators, coupled to compound open-type engines; and the boiler-house contained three Lancashire boilers 26 ft. by 7 ft. Successive extensions brought up the total capacity of the power station to 1710 kilowatts, which permitted of all demands being met, with adequate

stand-by plant, until the latter part of 1911, when the maximum load was 1064 kilowatts. The Committee decided to increase the works further, and last December they requested the Electricity Engineer to report on the subject. The result was a decision to proceed with the extensions indicated. These included a 1250-kilowatt turbine-driven generator, which is capable of driving the tramways and of providing more than the town's present requirements in the matter of lighting and power. It was set in motion by the Mayor (Mr. T. Metcalfe), and one by one the other generators were shut off. The result was to show that on less than half load the turbine was able to do the whole of the work. The visitors then made their way to the gas-works, where the Assistant-Manager (Mr. R. S. Ramsden) explained the various sections of the plant. The works occupy about 7 acres of land, and comprise two retort-houses; the new one standing on the site of four old houses which contained 150 direct-fired retorts. This house was completed in 1910; and the present was the first occasion of its inspection.

At the close of the inspection, a hearty vote of thanks was accorded to Alderman Lowe for the very entertaining afternoon with which he had provided the visitors. Appreciative remarks with reference to both the gas and electricity undertakings were made, and were endorsed by the Mayor, who stated that the gas-works were almost free from debt—there being only about £27,000 remaining unpaid of £235,000. Alderman Lowe, in returning thanks, said the Mayor had mentioned that the gas-works were nearly free from debt. Another point to be borne in mind was that there was a reserve fund of more than £15,000, which really reduced the debt to £12,000. The Committee had satisfied themselves that it would be to the advantage of the Corporation to have show-rooms in which to exhibit modern kinds of fittings and everything appertaining to lighting both by electricity and gas. They proposed to spend £3000 on these rooms; and he felt that their record entitled them to the confidence of the public in taking this step. In conclusion, Alderman Lowe said the Committee felt satisfied that the £35,000 they had laid out on the gas-works and the £20,000 on the electricity-works recently, had been well spent; there being indications already in this direction, in spite of the adverse conditions they had had to face in the increased price of fuel. Alderman Lowe paid a warm tribute to Mr. Hall, for the thoroughly efficient and assiduous way in which he carried out his duties, to Mr. Ramsden, to Mr. Beck, the Architect, and to the Contractors.

ASHTON-IN-MAKERFIELD GAS UNDERTAKING.

At the Meeting of the Ashton-in-Makerfield Urban District Council on Monday evening last week, the first annual report of the present Gas Manager (Mr. Burton) was submitted. It showed that the gross profit amounted to £2478 (an increase roughly of £60), and the net profit to £694, or £107 more. Out of the net profit, £384 had been placed to capital for new mains, services, and meters, compared with £568 before. There was an increase of £303 in the revenue from the gas consumers, but the pubic lighting was £150 less. The total quantity of gas made during the year was 56,011,900 cubic feet, compared with 54,280,000 cubic feet before. Bearing in mind that decreases were recorded in the first six months of the year owing to the miners' strike and its after-effects, these results might, Mr. Burton thought, reasonably be considered satisfactory. The average cost of coal worked out at 12s. 10½d. per ton, and that of the coke sold at 12s. 11½d. per ton.

The Clerk to the Council (Mr. A. Sykes) submitted a statement of the financial position of the gas undertaking. It showed that the expenditure on revenue account amounted to £6840, against £6760 for the preceding year; while the income was £9319, compared with £9179—an increase of £140. The result was, as stated by the Manager, a gross profit of £2478, and a net profit of £694. Mr. Sykes strongly recommended that a reserve fund should be formed, so that a certain proportion of the profits made during any year might be placed to it. From this fund money might be taken to carry out extensions to works classed as capital expenditure. Out of the balance at present accumulated—viz., £3627—a sum of (say) £2000 could now be transferred to the fund.

In moving the adoption of the minutes of the Gas Committee, Mr. J. Roberts said he should like to compliment the Manager on his first annual report. It would be noticed that he had increased the profits on the gas during the year by over £60. The gross profit was £2478, in spite of the fact that the cost of coal was £346 more than in the previous year. There had been 56 million cubic feet of gas made; but they had only accounted for about 46 millions. Consequently, they had some 10 million cubic feet of gas unaccounted for, which had been lost through subsidences. Taking all things into account, he considered the report very favourable.

The minutes were passed; and the Clerk's suggestion as to the formation of a reserve fund, and the transference to it of £2000 from the accumulated profits, was agreed to by the Gas and Lighting Committee.

AN INQUIRY AT DARWEN.

Mr. T. Duxbury on Gas Profits and the Rates.

A long discussion took place last Wednesday, in the course of a Local Government Board inquiry by Dr. W. A. Brightmore, regarding an application by the Darwen Corporation for sanction to borrow £6400 for the electricity undertaking, £11,500 for purposes of water supply (including the construction of a reservoir to hold a million gallons), and £21,000 for the gas-works. It was in connection with the last item the argument mainly arose—Councillor Duxbury seeking to get a short period fixed for the repayment of the loan, so that the Corporation should have no money to hand over to the rates.

The Town Clerk explained that the money was needed for remodelling the carbonizing plant. The existing retorts were of the ordinary horizontal type; and it was proposed to adopt in their place the Munich system. The Inspector asked the Engineer (Mr. A. H. Smith) why this system was preferred to verticals; and Mr. Smith replied that it required less space and the cost of manufacture was reduced to a minimum. The wear and tear of other systems was greater than that of Munich chambers. He added that he did not know how he would get through the next winter, and would like to start on the work as soon as possible.

The Inspector having invited remarks, Councillor Duxbury said he was not present at the opening of the proceedings, and so did not know whether the Inspector had inquired as to the wisdom of a small town like Darwen adopting a system which had not been adopted by any other corporation in this country. The point he really wished to deal with, however, was the time to be allowed for the repayment of the money. So long as the Town Council followed the pernicious and dishonest system of making the gas consumers pay thousands of pounds to the rates, they ought not to go on piling up capital at this rate. The utmost time the Board ought to allow for the repayment of this loan was seven years; and if the Corporation were limited to this period, they would have no money to hand over to the rates—which was just what he wanted to stop. He opposed the transference of profits to the rates, and would continue to do so as long as he was a member of the Council. It was, he thought, the policy of the Local Government Board and some of their inspectors to discourage such transferences and the piling up of capital. Councillor Davies remarked that they were paying off large sums regularly in sinking fund allocations; but Councillor Duxbury retorted that it was simply by charging more than they need for gas that they had been able to do this, and the gas consumers, not the ratepayers, had paid the money. The Town Clerk pointed out that whereas in 1894 the capital was £155,000, on March 31 last it stood at £92,245, with a production of 70 million cubic feet of gas more. Mr. Duxbury was simply trying to get a thing here which he had failed to get in other ways. The Corporation had never been unreasonable in the matter of profits. He did not think they had taken above 1 per cent. as a rule. They desired 25 years for the repayment of the loan. The Town Clerk remarked that, of course, there was no precedent for time in this case; but he doubted whether the period would be as long as 25 years.

NOTTINGHAM GAS EMPLOYEES' LOCK-OUT.

Nottingham resounded last week to the beating of the trade union drum. Primarily, the exercise had been devised in the interest of employees engaged in the Corporation Gas Department; but the lock-out of tinsmiths from the Woodborough Road meter-repairing shops was made the occasion of a crusade against all and sundry who had declined to swear allegiance to the trade union cult.

Mr. Thorne's former West Ham colleague, Mr. Arthur Hayday, Secretary of the district branch of the Gas Workers' and General Labourers' Union, was in particular evidence at most of the gatherings; the petty tyranny alleged to be practised in many of the Corporation departments forming his congenial text. Regarding the gas-workers' dispute, Mr. Hayday was responsible also for the assertion that, as meter-repairing work was at a standstill, the Committee were buying new meters to cope with the difficulty entailed by the lock-out; and this was cited as evidence that the wealth of the city was being used to crush out the spirit of combination among the tinsmiths. However, inquiries in official quarters subsequently showed that no purchasing had been resorted to.

Dissertations gave place to more businesslike methods on Thursday, when a deputation representing the disaffected hands met Alderman Bell, the Chairman of the Gas Committee; the point which had caused a breakdown in the earlier stages of the negotiations having been conceded, by the agreement also to see Mr. Gordon, of London, the Secretary of the National Union of Amalgamated Sheet-Metal Workers and Braziers, in company with the men. The proceedings extended over three hours; several of the workmen engaged at the meter-repairing shops giving evidence. It was understood at the close of the sitting that the whole of the statements having been heard, the matter would be further dealt with at a meeting of the Gas Committee, which was held the following day. It was then decided, however, that, pending communication with Mr. Gordon, no information should be given to the Press as to the outcome of the deliberations.

It has since transpired that the terms offered by the Gas Committee are not, in the opinion of the workmen, such as can afford a satisfactory basis for the settlement of the difficulty. It is understood that, with respect to the future action of the foreman of the shop, they meet with acceptance, in so far as his limitation of ultimate authority and method of dealing with the men are concerned. But the Committee, it is complained, make no proposal as to removing from the shop the non-union hand said to be the original cause of the trouble; and unless this demand also is conceded, there appears to be very little prospect of an early adjustment of matters.

It has been openly confessed that the tacit understanding arrived at four years ago, under which the union hands consented to continue working so long as the other operative was not forced upon them, did not then entirely satisfy the majority of the hands, though it was acquiesced in for the sake of an immediate solution. Now the strongly voiced feeling appears to be that this mistake, from the organizing point of view, is not to be allowed to be repeated. Informal gatherings of the men, at which the situation was again discussed on Saturday, left no doubt as to their attitude; and unless a *modus vivendi* can be suggested by the Committee at the adjourned meeting to be held in the course of a few days, the struggle seems to be likely to be of a prolonged character; adequate precautions being threatened by the men as to preventing any of the Nottingham Corporation repairing work being done elsewhere.

The case is significant as illustrating modern-day labour methods in their most uncompromising form. According to the ruling which is sought to be enforced in this instance, the Committee are not to be permitted to protect a workman about whose technical competence no question has been ever raised, but whose only fault is that he has resolutely refused to contribute to the Trade Union coffers.

TOTTENHAM PUBLIC LIGHTING.

Acceptance of the Gas Company's Tender Recommended.

The Engineer of the Tottenham Urban District Council has just issued his reports upon the tenders received for public street lighting from the North Metropolitan Electric Power Supply Company and the Tottenham and Edmonton Gas Company for periods of one, three, five, seven, and ten years respectively.

Dealing first with the tender of the Electric Light Company, the Engineer points out that they already supply electricity to 140 arc lamps in the district, at a cost per annum of £2201; and under an agreement, the Council are bound to continue the present system of lighting for these lamps until April 15, 1918. From a tabulated statement of the tender received from the Company, giving the number of existing lamps with their candle power, and comparing the prices with those in the tender received from the Gas Company, it appears that 188 lamps are affected. The tender for three years for lighting, maintaining, &c., these lamps is £614 13s. per annum, against £721 10s. by the Electric Light Company, or a saving of £106 17s. per annum. Under the tenders for five years, the Gas Company's price per annum is £601 12s. 4d., against £679 14s. for electric lighting, or a saving of £78 1s. 8d. per annum. The Gas Company's tender for seven years is £575 4s. per annum, against £656 14s. by the Electric Light Company, or a difference of £81 10s. per annum in favour of gas-lamps. With regard to the tenders for ten years for 188 lamps, the Gas Company's price per annum is £562 3s. 4d., against £640 10s., or a saving per annum of £78 6s. 8d. by gas lighting. To the above cost must be added the expense of the removal of the 188 lanterns, burners, and gas supplied, if any tender for electric lighting is considered, as the Power Supply Company's tender includes neat ornamental swan-neck brackets with enamelled reflectors, lamps, &c. No tender is submitted for electric lighting for one year. Should a portion of the Power Supply Company's tender be accepted, a corresponding reduction in the number of lamps must be made in the Gas Company's tender.

From a sliding-scale attached to the tabulation of the Gas Company's tender for periods of one, three, five, seven, and ten years respectively, together with an alternative proposed by them on the sliding-scale basis, it appears that, when there is a reduction of 1d. per 1000 cubic feet, it will only reduce the amount by £171 15s. per annum; and as it is considered to be highly improbable that the price of gas will be lower than 1s. 9d. during the next ten years, the allowance per annum might vary from £171 15s. to £687. The present account for gas is £5579 1s. 4d., and should the price be reduced by 4d. per 1000 cubic feet immediately, the annual payment would be £4892 1s. 4d., against an annual charge of £5025 15s. 10d., if the Company's tender for ten years is accepted.

The Engineer had an interview with the Gas Company's Engineer (Mr. A. E. Broadberry), and pointed out that the Company's tender shows a reduction of 2s. per lamp on the seven-years' basis, but that a reduction of only 1s. per lamp is given if the period is from seven to ten years. He also expressed the opinion that so small a reduction would probably not induce the Council to consider a contract for ten years. He has since received a letter making a further reduction of 1s. per lamp per annum for the latter contract, on the "C" or "Howlite" type, bringing the price to 45s. gross or 43s. 2½d. net. The offer was also modified to exclude the existing roads lighted by electricity; but it was hoped that, when the contract referring to these roads expired, an opportunity would be given the Company to submit a fresh tender. On the revised figures, a saving of £646 13s. 3½d. per annum would be effected if a ten-years' contract were entered into, or a total sum of £6466 12s. 11d. for the whole period.

In conclusion, the Engineer says: "The terms offered by the Gas Company for a ten-years contract appear to be most favourable; the only objection being the possibility that gas lighting might undergo some drastic alteration during that period. This difficulty, however, was overcome by the Company consenting to an agreement embodying a clause enabling the Council to terminate the contract at the end of five years should any substantial change take place in the general methods of public lighting by gas."

Having carefully considered the tenders, and as the prices for electric lighting exceed those for gas, and the Electric Light Company propose to deal with only a limited number of roads, the General Purposes Committee decided not to take any action with regard to their tender. They, accordingly, recommended the Council to accept the tender of the Gas Company for a period of ten years, subject to the execution of a proper agreement, and subject also to provisos that, if the price of gas to ordinary consumers is reduced to 1s. 9d. per 1000 cubic feet in five or seven years, or if any substantial change takes place in the method of public lighting, the Council may terminate the agreement with a view to making other arrangements.

MONTE VIDEO GAS COMPANY.

An Increase in the Dividend.

The Ordinary General Meeting of this Company was held on Thursday last, at Winchester House, Old Broad Street, E.C.—Mr. T. C. TATHAM in the chair.

The SECRETARY (Mr. Henry Kearns) read the notice convening the meeting and the report of the Auditors; and the Directors' report and the statement of accounts (*ante*, p. 551) were taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, referred first of all to the figures which he thought would be of interest to the proprietors. On the debit side of the balance-sheet, the capital, reserve, and insurance funds were unchanged. To the reserve for renewals, the Board had from the past year's profits added the sum of £4500, bringing the total up to £22,000. The contingency account was practically the same as in the previous year. Sundry creditors in Monte Video showed an increase of £298, and in London of £1000. The total amount owing (£10,399) included, however, various accounts which had since been paid. On the credit side, there had been written off for depreciation the sum of £4853—practically the same as last year; and there had been expended on additional mains and meters £5528, which was about £3300 more than in the preceding twelve months. This brought the total capital expenditure up to £536,496, as against capital receipts of £570,600. Stocks of coal and other materials showed the considerable increase of £6390, of which coals accounted for more than one-half. The tonnage was greater, and the value per ton was also more, chiefly owing to the high rates of freight. Gas-fittings accounted for an increase of £1415, most of which was allocated to the increase in the stock of gas-cookers let out on hire, and the larger stock of bath-heaters and gas heating-stoves, all of which were growing in popularity. In many cases the cookers were taken on the hire-purchase system; and to this extent, of course, the money would be returned. The item of sundry debtors was £3084 less than last year. All the investments were valued at market price, and provision had been made for depreciation from the profits of the year. Included in the amount thus provided was the value of two houses which were built before the Company took possession of a piece of land upon which their manufacturing operations were carried on. As the site was now required for a new retort installation, the houses had been pulled down, and their value written off. Turning to the revenue account, the gross receipts in Monte Video increased by £14,429; but, on the other hand, the expenses were higher by £9358. Coal had cost more than the previous year. Contracts had been made ahead on favourable terms, and the Company were not therefore materially injured by the great coal strike. But there were difficulties in obtaining coal; and the rise in freight rates was very considerable—not only upon coal, but upon all materials shipped. Wages, too, in Monte Video, as in so many other parts of the world, were always increasing; and this had affected them in both the gas and dock departments. In spite of it, however, the Company were able to show on the working in Monte Video an increased profit on revenue account of £5527. He was afraid they had not yet seen the end of the increase in the expenses of manufacture; for there was a strong agitation in favour of an eight-hour day, and they could all form an opinion of what this meant. The profit and loss account showed a balance to deal with of £34,864, including, of course, the sum of £12,495 brought forward. From this there had been paid a dividend at the rate of 6s. per share, or 3 per cent., for the first half of the year; and the Directors now proposed to pay a dividend for the second half at the rate of 5 per cent., or 10s. per share. They would also be able to increase the carry-forward by the sum of £692. As to the reserve for renewals to which he had already alluded, the shareholders would remember that the Board had been anxious for some time to replace part of the existing carbonizing arrangements by more modern plant, by which they hoped to effect certain economies; and he had told them at the meetings that, as the Directors had had notice that a most important part of their works might be required for an improvement scheme in Monte Video, which was known as the Southern Embankment Scheme, they considered that it would be imprudent to lay out any considerable amount of capital on the works until they knew how the Company's interests would be affected. The scheme to which he referred seemed to be abandoned for the present, though possibly it might be revived in another form. In the best interests of the Company, the Board thought they could not longer delay the long-thought-of installation; and details were being prepared of their requirements to place before contractors, in order that the Directors might decide on the system, relative to the cost, best suited to these requirements.

Mr. JOHN MEWS formally seconded the motion.

Mr. MALLET remarked that, as he had on several occasions adversely criticised the accounts of the Company, he wished on the present occasion to congratulate the Board on making an increase in the dividend—the first time for many years. It was not so good a dividend as he thought they ought to get, with the existing state of affairs in Monte Video. He had known the city for over thirty years; and every time he went out there he was struck with the vast improvements that were being made. He hoped the day was not far distant when the Company would participate fully in the progress of this great city, and that the efforts of the Board would bring back the prosperity which the undertaking formerly enjoyed.

The CHAIRMAN said they hoped the increasing prosperity of Monte Video would help them; but, at the same time, it must be remembered that they had a most formidable competitor in the electric light. The conditions under which they competed with electricity were not quite the same as those existing in most other cases, because their competitor was the Government itself. The Government was free from the imposts and taxes which the Gas Company, as a commercial undertaking, had to pay. Of course, if their competitors had been another commercial company, and also paid these imposts and taxes, the competition would not be so severe.

The resolution was then carried unanimously.

On the proposition of the CHAIRMAN, seconded by Mr. FRANK H. JONES, a dividend (in addition to the interim payment) of 10s. per share, less income-tax, was declared, making 4 per cent. for the year.

Moved by the CHAIRMAN, and seconded by Mr. JONES, the retiring Directors (Mr. John Mews and Mr. Charles Hunt) were re-elected; as also were the Auditors (Mr. George Sneath and Mr. Laurence E. Halsey, of Messrs. Price, Waterhouse and Co.), on the proposition of Mr. T. WILKINS, seconded by Mr. MALLET.

The CHAIRMAN proposed a hearty vote of thanks to the General Manager and the staff in Monte Video and the Secretary and the staff in London.

Mr. HUNT seconded this, and it was agreed to.

Mr. WILKINS, in proposing a similar compliment to the Chairman and Directors, said shareholders always wanted more than was given them. He thought the Company could have afforded to pay an extra 1 per cent., instead of the additional ½ per cent., which, however, they all appreciated.

Mr. MALLET seconded the vote, which was heartily agreed to.

The CHAIRMAN, in acknowledgment, said it would be a great pleasure to the Board to pay a higher dividend if it could be done. It was, however, their first duty to make themselves safe.

SOUTH BARRACAS (BUENOS AYRES) GAS COMPANY.

Increased Business and a Favourable Outlook.

The Ordinary General Meeting of this Company was held on Thursday last, at the London Offices, No. 1, East India Avenue, Leadenhall Street, E C.—Mr. J. C. IM THURN presiding.

The SECRETARY (Mr. W. Upton) read the notice convening the meeting and the report of the Auditors; and the report and accounts were taken as read.

The CHAIRMAN, in moving their adoption, said the profit for the year to Dec. 31 last was £3567, which was a distinct improvement over 1911; and as this was after paying interest on loans, it was the more satisfactory. The Directors were glad to be able to report that the business had made a good advance; the total increase of gas sold having amounted to 9,277,000 cubic feet, of which 2,241,000 feet was due to private lighting, and 5,446,000 feet to heating and cooking. Coals cost somewhat more; and the increase would have been considerably greater, had it not been for the fact that they were now obtaining a much larger yield of gas per ton of coal than previously. Freights had also continued at a higher figure throughout the year than they had been accustomed to. Maintenance of works cost £557 more; and the item of manufacture of water gas showed an increase of £595. This plant was of the greatest use in meeting sudden demands for gas; but the high price of oil made it expensive to work. When the new retorts which were now on order were erected, the use of the water-gas plant would be much restricted, for reasons of economy. On the credit side of the revenue account, there was an increase of no less than £3208 from gas sales, and of £2216 from residuals. From the latest reports to hand regarding the working of the Company during the present year, it appeared that the output of gas continued to steadily increase. They were advised that the prospects were excellent, and that building in all the Company's districts was brisk. The Secretary and Mr. J. M. Macmorran had both recently been over to South Barracas; and Mr. A. M. im Thurn, another Director, was now on a special visit to Buenos Ayres. During the past year, 505 additional meters had been installed—which was a record for the Company—and some extensions to mains brought the total up to 112 miles. The Company were successful last September in obtaining from the Municipality of Avellaneda a concession for twenty years. This concession strengthened their position very much, and satisfactorily defined the rates to be charged for gas, while (which was, perhaps, even more important) fixing the taxation at the present rate during the whole period. In the opinion of the Board, this concession was a good new asset for the Company, and they might congratulate themselves upon obtaining such favourable terms. Negotiations were also opened up last year with the Municipality of Lomas, with a view to getting a fresh contract for the lighting of the streets in this important and rapidly growing district. As the result, a contract had been obtained which would secure to the Company their present public lighting over the next thirteen years, together with the important stipulation that there shall be no increase in taxation over the amount at present paid. The previous contract threw upon the Company the onus of collecting from the persons individually their portion of the cost of public lighting, in the form of a lighting tax; and this, of course, was at all times a delicate matter for a private company to undertake. By the new contract, the collection would be made by the Municipality direct, and they would pay the Company monthly the charge for the service. The Directors were advised that in the immediate future there would be a considerable increase in the number of public lamps requiring to be lit with gas, which showed appreciation of the manner in which the public lighting had been conducted. During the current year, too, the Great Southern Railway would commence to take a large quantity of gas from the Company for the purpose of lighting their coaches. The latest forms of lamp were being let out to customers at a monthly rental; and the rent of lamps on hire showed an increase last year of no less than £706. Two new show-rooms had been opened, and equipped with all the most modern gas appliances. Owing to the large increase in the output of gas the retort capacity at the works had become very much strained; and in view of the increases which were still taking place, and which there was every assurance would continue, the Manager (Mr. R. B. Brown) had stated that it was absolutely necessary that an addition be at once made to the gas-making plant. The Directors had therefore entered into a contract for the erection of four new beds of retorts. In addition to this, they were advised that it had become necessary to put up a gasholder of 500,000 cubic feet capacity in the district of Lomas, which was about 10 miles from the works. The Board were convinced that it would be best to undertake this work without delay. When they met last year, he told them that great changes had been made in the management in South Barracas—that a new Manager had been appointed, and had just taken charge. He added at the same time that the indications were favourable, and that the Board hoped to have better results to report at the next meeting. They were now in this happy position; and if the net result of the year were not as great as could be wished, it reflected great credit on the staff. They must take into account not only that Mr. Brown's appointment was still very recent, but that he only had charge for some eight months in the year under review. The Directors had not yet decided as to the best mode of providing the new capital which was necessary; but they hoped to make the issue before long. It might be asked whether the amount required for paying dividend or interest on the new capital would not be a greater burden on the undertaking than it could stand without serious detriment to the shareholders; but it was not anticipated that this would be at all likely, because of the economies which were expected to result from the erection of the new plant, and the increase which was steadily going on in the general business. The Directors thought they were quite justified in looking for considerable improvement in profits during the present year; and the new concessions and contracts to which he had alluded should greatly contribute towards this end.

EFFICIENCY

With the **CALEFACTOR**

in use, a very large
supply of really

HOT WATER

can be had at

ANY TIME

The heating is done,
not only

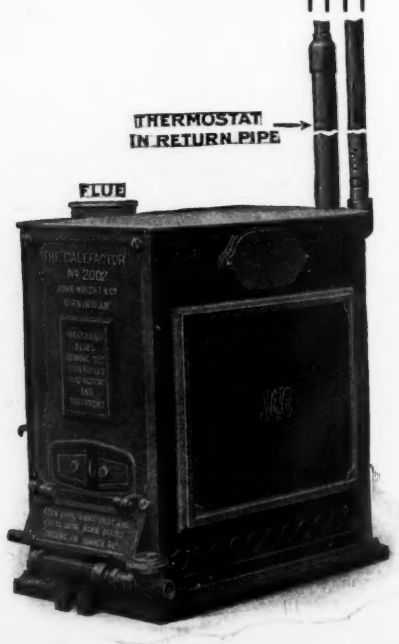
VERY QUICKLY

but with the greatest

ECONOMY

in gas consumption.

JOHN WRIGHT & CO., Essex Works, BIRMINGHAM.



Mr. J. M. MACMORRAN, in seconding the resolution, spoke of the necessity for erecting the new holder at Lomas, which would not only give a better service of gas in the district, but would effect a considerable saving in the cost of manufacture. He stated that during his recent visit he had been greatly struck by the signs of growth in the area served by the Company. The population was increasing rapidly. It said a good deal for the management that, in spite of the abnormal rise in the price of coals and freights, the trading profits in 1912 had been trebled over those of 1911. With fair prices for fuel, he was sure they would see a steady increase in profits.

The report was adopted, and a dividend of 2 per cent., making 4 per cent. for the year, free of income-tax, was declared. The retiring Directors (Mr. R. Nesham and Mr. Macmorran) and the Auditors (Messrs. Arthur Goddard and Co.) were re-elected.

Votes of thanks were subsequently passed to the staff and to the Chairman and Directors.

Mr. MACMORRAN, in proposing the former, said that it had been a very great pleasure to him to see the marked and steady improvement in the conduct of the Company's business. Mr. Brown, he considered, was the very man they wanted in South Barracas. He seemed untiring and energetic, and was undoubtedly succeeding in his work. It had been a period of great anxiety; but they had suffered very little from the rising prices of materials, and this was due to the good carbonizing results obtained by their Manager.

USE OF TAR FOR ROAD SURFACING.

Alleged Destructive Effect on Fish.

The Hampshire Automobile Club have had before them the question of the cause of the destruction of fish in the Itchen River, near Winchester; and they requested the Hon. Secretary of the Northern Division (Mr. Charles E. Godwin) to obtain opinions on various points connected with the matter. The object of making the inquiries was to ascertain whether or not the giving of an undertaking by the Winchester Corporation not to use tar on the roads for a period of three years, owing to alleged destruction of fish therefrom, was unavoidable. We have been enabled to peruse the report, which has not been published, and make the following extracts from it.

From the 26th of April to the 8th of September, 1911, the principal roads in Winchester were coated with tar supplied in accordance with a specification given in the schedule to the report. This specification is one prepared by Mr. W. J. A. Butterfield, M.A., F.I.C., Assoc. Inst.C.E., after a series of experiments, and was designed to reduce to a negligible quantity such components in coal tar as were known to be dangerous to fish life. The tar from each consignment was not laid until a sample had been certified by Mr. Butterfield as complying with his specification. The conclusions arrived at by him as a result of his experiments, and on which his specification is based, are also set out in the schedule.

No rain fell in Winchester after June, 1911, until August in that year. From Aug. 24 to Oct. 21 there fell a total of 2·10 inches of rain. In the 24 hours preceding nine o'clock on the 22nd of October there fell an inch of rain; and there was heavy rain the following two days. After the rain on the days named, it is estimated that 80 per cent. of the fish in the Itchen in and within two miles below Winchester were killed; and the majority of those that survived were partially or totally blinded.

The visitation was attributed to the tar or its effects; and the Corporation of Winchester have, in consequence of representations made to them by the Test and Itchen Trout Fishing Association, given an undertaking not to lay tar on the roads for a period of three years, during which time it was hoped more information on the subject could be obtained, and the actual cause clearly defined. At the time of the occurrence, no samples appear to have been taken of the river water, but it is described as "coming down very thick."

The foregoing facts came before the Committee of the Club early last year, and, acting on their instructions, Mr. Godwin commenced investigations which he describes as follows:

1.—I obtained, by the courtesy of Major the Hon. Guy Baring, M.P., four live trout which had been affected by the visitation in October, 1911; and on the 4th of March I dispatched them to Dr. Bertrand at the Pasteur Institute, Paris. Three of the fish arrived alive; but one died. The object of sending these fish was to ascertain, clearly and distinctly, whether or not they were suffering from any disease.

2.—On the 24th of February I sent to Messrs. Angell and Angell a sample of road washings taken in Hyde Street on the 23rd of February last after a rainfall of 0·48 inch; and on the 9th of March a further sample taken after a rainfall of 0·51 inch.

3.—By the courtesy of the Surveyor of the city, I obtained a sample of the tar used; and on the 4th of March I dispatched it for analysis to Messrs. Angell and Angell.

4.—By the courtesy of the Town Clerk and of the Surveyor, an Ordnance sheet of the city of Winchester was marked with all the storm-water drains of the city that empty into the river.

5.—I instructed Mr. H. Priddis, whose knowledge of the fish and fisheries in or near Winchester is, from a practical point of view, well known, to report on the various stretches of the river, from St. Cross Mill to above the first storm-water outlet, with a view to ascertaining whether there was any difference observable in the quantity of healthy fish, and, if so, on which stretches the fish had suffered most.

Appended are the reports from the Pasteur Institute, Messrs. Angell and Angell and Mr. H. Priddis. The facts that can fairly be said to be established on these reports and on subsequent inquiries are:

(*a*) That the fish suffered from no disease, and that their condition was brought about by the introduction into the river of some foreign

MAINS' NEW SERIES.

The smallest cooker in our new 30-40 series is mounted on a stand.

It has a comparatively wide oven and it embodies the exceptional features of the larger sizes.

This cooker is going to be a great success. Its appearance is calculated to make a good impression, and a sample in your Showroom window will draw business.

R. & A. MAIN, LIMITED.

WORKS: Gothic Works, EDMONTON, N.; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.

SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 56, Broad Street, BIRMINGHAM; 83, Old Market Street, BRISTOL; 13, Whitworth Street West, MANCHESTER; 8, Exchange Place, Donegall Street, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

substance highly poisonous to trout, and injuring the cornea of the eye of those not killed.

(*b*) That the road-washings examined contained no substance or matter prejudicial to fish life; but it must be borne in mind that the sample was taken in February and March, some four months after the actual occurrence. Inquiries made show that, since Oct. 24, 1911, there has been no recurrence of the fish destruction, even after the heavy rains that have recently fallen after the spring drought.

(*c*) That the tar used was well up to Mr. Butterfield's specification, and as supplied, and as and when first laid, contained no substance in sufficient amounts to be poisonous to fish life under the ordinary conditions of weather and roads in England.

(*d*) That the destruction of fish in the various stretches of water varied with the extent of road surface drained by the various outlets into the water, and that north of the High Street on the main stream no damage, and in the weirs very little damage, if any, was done.

(*e*) That the damage was done between the 22nd and 24th of October, and has not been repeated since those dates, notwithstanding that there has been continuous heavy rain, and also a period of some weeks of drought followed by heavy rains.

The following are comments based on further information obtained in correspondence since the receipt of the reports mentioned above, and also from other inquiries I have made.

That some of the bodies contained in coal tar, and in particular the phenols, are possibly capable of chemical changes from exposure to sunlight and air; and these changes may form a substance which would be poisonous to fish life. To ascertain whether this is so or not, would necessitate an exhaustive chemical examination of tar exposed under similar conditions to those that existed prior to this visitation.

It further appears to be very doubtful whether, according to the suggestion that has been made, the mischief is caused from decomposing manure, &c., washed from the roads into the stream, and which, owing to the presence of tar on the roads, is not absorbed as it otherwise would be. It is possible, however, that old and imperfect storm water drains, or drains that present little or no fall, would favour such decomposition and the storing of such matter.

Messrs. Angell and Angell call attention to a possible source of danger from petrol or lubricating oil dropped on the roads. It will be within your practical knowledge that the falling of petrol on the roads is, if it occurs at all, in such infinitesimal amounts as to be negligible. A more likely source for the presence of petrol in the storm-water drains would be its introduction therein at garages and private motor houses, where it is frequently used for cleaning purposes, and where, instead of being thrown where it can endanger nothing, is possibly introduced into the storm-water drains.

With regard to lubricating oil, it is a fact that this oil is to some extent allowed to leak on to the roads. The quantity, however, is very small; and it is doubtful whether there would be sufficient to produce this effect on fish life. It is also to be noted that, if this be the cause, then it could be expected to have happened again in the rains after the spring drought, whereas nothing happened.

The same result to fisheries into which tarred road washings are allowed to drain has occurred in several other cases in England and in France; and fish biologists and other experts in both countries are at present engaged in trying to solve the problem of the real cause of the trouble. Until this is definitely and conclusively ascertained, I submit for your consideration the conclusion that the local authorities were not acting unreasonably in giving the undertaking referred to at the commencement of this report.

I also submit the following as being possible causes of the trouble, in the order of importance in which they present themselves to my mind:

1.—Chemical changes brought about by exposure to air and sunlight in the tar used, and especially in the phenoloid bodies contained therein.
2.—Decomposed manure, &c., washed from the tarred roads into the stream.
3.—Lubricating oil washed from the roads or from garages or private motor houses into the storm-water drains, and thence into the stream.
4.—Petrol washed into the stream from garages and private motor houses.

APPENDICES.

The following are the reports referred to by Mr. Godwin:

From the Pasteur Institute.

We beg to report that on the 5th of March, 1912, we received from you a can containing three live trout and one dead trout which had died *en route* from Winchester to Paris. The dead trout was immediately examined, and the live ones have since been examined, with the following result: All the fish present an opacity of the cornea which is not due to any pathogenic organism. It is impossible to say without a series of experiments with healthy fish whether tar-infected water has any effect on the eyes of the fish or not. So far as we have consulted with experts on fish disease, some answer the question in the affirmative and some in the negative; but the latter suggest that the mischief can be caused from decomposing manure, &c., washed from the roads into the stream, and which, owing to the presence of the tar on the roads, is not absorbed as it otherwise would be. We send this as a preliminary report, and shall be happy to report again on the matter towards the end of the year, when a series of experiments now being conducted will be completed

(Signed) DR. BERTRAND, D.Sc.
H. SPENCER BROWNE, M.B.

From Messrs. Angell and Angell.

Report on samples of road washings received on the 5th of March, 1912, and also on a sample of tar received on the 28th of February, 1912. The road washings have been submitted to examination, with the following results: The crude washings as received smelt of tarry matters, and upon the surface was an iridescent film. On distillation they yielded a distillate smelling when warmed still more of smoky and tarry matter. This distillate was tested for phenoloid bodies, but no reaction could be obtained. There could therefore be only very slight traces, if any, of such present. The sample yielded suspended insoluble matters equal to 292·6 grains per gallon (dried at 100° C). This

Richmond's "IRONCLAD" Circulator

Regd. Design
The "IRONCLAD."

IF you are still in doubt, we repeat that the "IRONCLAD," as the name implies, is strong and durable, and is constructed of High-grade IRON parts, five in number, practically indestructible. The "IRONCLAD" is the most suitable Circulator for placing on your Hiring List.

This alone should interest you, but when we add that the efficiency is equal to any circulator, it *must* convince you that it is in your own interests to test one so new in principle and so low in price.

The subject of maintenance is too remote to need a reference.

THE Richmond GAS STOVE & METER Co LTD

WARRINGTON & LONDON.

matter lost on ignition 52 grains per gallon. In solution, the matters were equal to 19·3 grains per gallon. The matter in suspension consisted mostly of very finely-divided particles.

The sample of tar was subjected to analysis, with the following results:

Sp. gr. at 60° Fahr. = 1·20.
First distillate below 170° C. = 1·58 per cent.
Second distillate between 170° C. and 270° C. = 18·4 per cent.
Distillation residue, pitch, &c. = 81·1 per cent.
Phenoloid bodies calculated as phenol expressed in grains per gallon of wash water = 2·49.
Ammonia in grains per gallon of tar = 0·49.
Water expressed in per cent. by volume = 0·12.

The above results show that the road washings contain only negligible traces of tarry matters, but that the mineral matters in suspension are excessive in quantity, and, when compared with ordinary road detritus, are extremely finely divided. The tar is well up to the County Council specification in every respect.

Mr. H. Priddis's report shows that in different parts of the river the fish seem to have been variously affected. He finds that there was certainly something or other that destroyed the fish in the river in a more or less degree from the electric light works to Otterbourne. Above the point where a double drain empties into the Abbey stream at the electric light works, the fish appear to be in a healthy and normal condition, with no sign of blindness or other disease.

MOTOR FUEL FROM GAS COMPANIES.

Under this heading, the "Autocar" for last Saturday referred to the recent gathering at the Savoy Hotel [see last week's "JOURNAL," p. 517] to hear Mr. H. L. Doherty, of New York, advocate the removal of the candle-power standard for the testing of coal gas, so as to provide more benzol for motor fuel. After giving quite a short account of the proceedings, Dr. W. R. Ormandy comments on the project.

He says: In an article written for the "Autocar" some time ago [March 1, 1913] on the subject of motor fuel, when referring to the possibilities of obtaining benzol from the existing gas-works in much larger quantities than had hitherto been the case, it was assumed that the gas-works manager had to provide the public with a product satisfying existing statutory requirements. It was pointed out that, in an ever-growing degree, our coal gas supply depended on the benzol and similar constituents for its light-giving properties. Of course, if we assume the possibility of a radical alteration in the laws of the country regarding the necessary candle-power of our public gas supplies, the whole subject must be reviewed from another standpoint.

In the early days of public gas supplies, iron retorts were used for containing the coal to be subjected to distillation. These, of necessity, limited the temperature employed; and in those days high candle-power gas with comparatively little sulphur—suitable for use with fish-tail and argand burners—was the common supply. With the introduction of fire-clay retorts, the gas managers were able to use higher temperatures, and so to increase the yield of gas; so that Parliament imposed limitations of candle-power to protect the user who might otherwise have been forced to take gas almost unfit for use in the burners then available. To keep up the candle-power and at the same time to get high yields of gas, cannel coals were largely employed in spite of the low-grade coke resulting. With the increased cost of cannel coal, due to the working-out of the larger and more easily worked seams, came the use of water gas enriched with oil which was cracked to yield illuminating gases.

Then came the period of the incandescent mantle, resulting in a general appeal to Parliament for the right to supply gas of lower candle-power suitable for incandescent work, but not so poor that it would not give reasonable results with the now almost obsolete flat or fishtail burner.

Now it has been proposed to ask Parliament that even this lower standard of candle-power shall be removed. If the proposed alteration in the law simply consisted in removing this restriction without the imposition of something in its place, and we assume that the existing gas-works proceed along existing lines, except that they wash out the benzol, what will be the position of the general public?

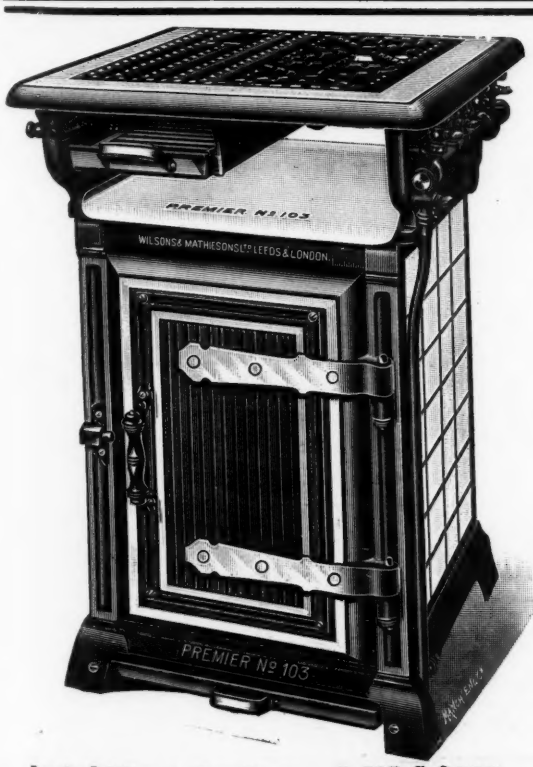
A small proportion of the gas employed at present (estimated at 5 per cent., I notice) is used in the old type burners—generally in places where there is great danger of mantles getting damaged, as in engineering shops, warehouses, or where a small light is required over long periods, as in passages, &c., and in the houses of the very poorest people. Probably there is nothing in all this that can justify stopping a movement which in other directions can be shown to be of general benefit to the community.

It is a matter of great interest, and happens most opportunely, that, of all the light-giving constituents in coal gas, benzol is the one which exerts the greatest light-giving influence in proportion to its heat-giving powers. The laws of simple proportion are set at naught in the gas and photometric world. The addition of known quantities of high lighting-power gases to a bulk of gas of lower lighting value does not act as might be thought in direct proportion, but in a degree which varies for every individual gas. The accompanying table, taken from Professor Lewes's book on the carbonization of coal, illustrates this point:—

	B.Th.U. Gross per Cubic Foot.	Candle-Power per 5 Cubic Feet.	B.Th.U. Gross per Candle.
Hydrogen	325	—	—
Methane	1024	5·2	985
Ethane	1870	35·0	267
Propane	2682	53·3	253
Ethylene	1603	70·0	115
Benzene	3718	820·0	23

Assuming that the figure which has been given is correct, and there are about 2½ gallons of benzol per 10,000 cubic feet of coal gas, then it

POINTS ABOUT "PREMIER" COOKERS.



1. NEW ARRANGEMENT OF TOP.
Improved design of TANGENT BURNERS set in most convenient positions.

2. HINGED HOTPLATE.
Works on a self-locking principle.

3. LARGE DOUBLE GRILL.
Separately controlled and easily worked with pan on runners.

4. NO PROJECTING TAPS.
Gas-Taps fixed well within cover of hotplate moulding.

5. OVEN.
Spacious and perfectly ventilated. Improved fittings, also spring catch to door.

6. APPEARANCE.
Attractive addition to kitchen and easiest cooker to keep clean.

London Office & Show-Room: 76, Queen Street, Cheapside, E.C. **WILSONS & MATHIESONS, Ltd.,** CARLTON WORKS, ARMLEY, LEEDS.

can be calculated out that its removal would reduce the heat value of the remaining gas by about 6 per cent., which is the figure mentioned by Mr. Butterfield in the discussion following the delivery of Mr. Doherty's address. Further, we may safely take an average price of 2s. 6d. per 1000 cubic feet of coal gas, equal to 25s. per 10,000 cubic feet. The public will receive a gas having 6 per cent. less heating value, and will for the same work have to consume 6 per cent. more. That is, pay roughly 1s. 3d. per 10,000 cubic feet extra to the gas-works to enable the latter to extract 2½ gallons of benzol. It is further stated that washing-out this benzol will cost gas-works 1s. per ton of coal, equal to 1s. per 2½ gallons of benzol to be sold at 1s. per gallon.

If these figures are correct, the gas-works will have a credit of 1s. 6d. per 10,000 cubic feet of gas made, due to the increased value of benzol over the cost of obtaining the same; but they will owe it to the consumer to reduce the price of gas 1s. 3d. per 10,000 cubic feet to compensate for the reduction in heat value. In all, this benzol is valued at 1s. per gallon at the gas-works. Will the gas consumer be satisfied with what is change for a shilling so far as he is concerned as regards heat value, with a few minor disadvantages thrown in.

If Mr. Kay has no light limitations in Manchester legally imposed, then he is in an excellent position to study this matter thoroughly. If he can offer his customers a gas of equal heating power, or even slightly higher, no richer in sulphur (I work in Manchester) and can at the same time win benzol from the gas at a profit, there remains only a canvass of the consumer to find out whether the 5 per cent. really is only 5 per cent., and whether these adherents to the methods of the past are too powerful to be ruled out of court.

Needless to say, the position is by no means the simple one assumed above. Once do away with the candle-power limitation, it will be absolutely necessary to introduce a heat value standard with or without a limitation as to the allowable proportion of the poisonous carbon monoxide. Once the gas-works manager realizes that, so long as he supplies a gas of, say, 500 B.Th.U. gross per cubic foot, he can disregard all else, he will begin to amend his method of manufacture.

If anything can be read out of the present tendencies in gas-works methods, it points to the introduction of continuous vertical retorts; and if the candle-power limit be replaced by a thermal standard, then the development would seem likely to proceed along the lines laid out by Professor Lewes—viz., the introduction of the maximum amount of water gas into the retorts, with the threefold object of increasing the ammonia yield, increasing the total gas yield, and retaining as much as possible of the carbon of the coal in the gaseous form.

These conditions, however, tend towards the production of paraffinoid hydrocarbons in the place of benzol-like bodies, and these paraffinoid bodies with a comparatively low light-giving capacity have a very high heat value, and will be required in the gas to give it the necessary heating value. In other words, the removal of the candle-power restriction may, and probably will, bring about such alterations in the methods of gas manufacture as prohibit the production of benzol or even of a substitute therefor.

I am aware that a certain section of my critics will again refer with anger (or may be sorrow) to what will be called my pessimistic attitude; and I hope to be able, in a subsequent article, to refer to the opinion of some leading authorities in the gas world. But in any case nothing is to be gained by looking at a subject from one point of view only. Wild and ignorant enthusiasts for a cause often do more harm than good.

In the address given by Mr. Doherty, and in the subsequent discussion, certain figures were produced—that the possible benzol production of our gas-works was 60 million gallons, presumably from the gas alone, and not including the amount from the tar now extracted. Allowing 2½ gallons per ton, this gives 24 million tons of coal carbonized—somewhat above the figure generally accepted, which, speaking from memory, is about 15 million tons.

The general position is hereby in no wise altered, and I have merely endeavoured to put the matter as it occurs to one interested in the subject from many aspects.

Speaking last Thursday at the Institute of Inventors, on "Petrol and its Substitutes," Mr. Robert W. A. Brewer, the First Chairman of the Motor Union Fuels Committee, said that throughout the world the fuel question was a most important one, and England was not the only country where the cost had gone up enormously. Fuel must march with apparatus; and if they had apparatus which progressed with the times they could utilize crude fuel in it which they had never expected to use. He did not anticipate that Great Britain could produce anything like the amount of liquid fuel which it required; but, if sufficient encouragement were given to producers of distillates from various substances, there was not the least doubt that in a few years' time a long step could be taken in the direction of our being home producers. Proceeding to speak of petrol substitutes, Mr. Brewer said there was a possibility of alcohol, suitably treated, coming into the field and filling a place which was waiting to be filled. The result of his own experiments showed that certain important matters must be complied with by any fuel substitute. Paraffin, for instance, could be utilized in conjunction with a volatile spirit in an ordinary carburettor; and it could be treated alone in order to render it suitable for motor-car work. Owing to the great restrictions placed upon it, alcohol was not at the present time a suitable fuel for further experiment; but benzol, on the other hand, was shown to be eminently suitable, and was a fuel which should receive greater encouragement. An increase in specific gravity, accompanied by the production of a suitable carburettor, was the only solution of the fuel problem.

Mr. R. Gamble Marks has been giving some excellently attended free cookery lectures, in connection with the Chorley Corporation Gas Department. Great interest was taken in his "heat distributor," which he used for cooking in a stove of the pattern which is supplied free of rental to consumers by the Corporation.

"CANNON" GAS COOKERS.

The "County"

Still maintains its POPULARITY, OWING TO ITS MANY ADVANTAGES.

It is to your interest to have this COOKER ON YOUR HIRE LIST.

AN IDEAL COOKER FOR HIRING-OUT PURPOSES.

Ask for a supply of our NEW SEASON'S BOOKLETS, Free on application.

CANNON IRON FOUNDRIES, Ld.,

DEEPFIELDS, Nr. Bilston, Staffs.

London Office and Show-Rooms:—

18, HOLBORN VIADUCT, E.C.

Australasian Agents: MOLDEN & BUDDEN PTY., Ltd., 364A, Little Collins Street, Melbourne, Vic.; and at SYDNEY, N.S.W.

AGRICULTURAL FERTILIZERS AND FISH LIFE.

Under this heading, Mr. W. J. A. Butterfield, F.I.C., Assoc.Inst.C.E., had a letter in "The Field" for the 17th inst. About fifteen months ago, he gave an account of the results of a number of investigations he had made bearing on "The Relation of Modern Road Surfaces to Fish Life." Most of these investigations dealt with the possibility of the direct pollution of surface washings by various descriptions of tar and asphalt which have of late years come largely into use as road-surfacing materials. But reference was incidentally made to the increase in the indirect pollution of surface washings arising from the impervious character or water-proofing effect of tarred and asphaltic road-surfacings. In connection with the investigation, a few comparative experiments were made on the effect on fish life of solutions of one or two of the most widely used agricultural fertilizers. In regard to these, however, the investigations were admittedly far from exhaustive. It was suggested to Mr. Butterfield that cases of injury to fish for which no sufficient explanation had been given, might, in fact, have been due to contamination of the water by the surface washings or drainage from neighbouring agricultural land, which had been treated with some manure or artificial fertilizer. The suggestion led him to undertake some further investigations, the results of which, with a few remarks on the conclusions which he thinks may reasonably be drawn from them, are given in his letter. The fertilizers, &c., investigated were bought in the ordinary way from trustworthy dealers, with the exception of cyanamide, which, being little used in this country, was obtained from a well-known German dealer in chemicals. They were mixed in various proportions, and their effect tried on gudgeon. One part of sulphate of ammonia in 1000 parts of water caused death in 60 minutes; but with 0·1 part, the fish were unaffected in 18 hours. Calcium cyanamide, mixed in the first-named proportion, killed the fish in 90 minutes; but a mixture of 0·25 to 1 was not fatal till after 12 hours. Lime, 1 to 1000, was destructive in 20 minutes; but with a mixture of 0·1 to 1000, the fish were unaffected in 18 hours. Drainage from stable manure, equal to 0·2 part of ammonia in 1000 parts of water, killed fish in 24 hours.

The results tabulated by Mr. Butterfield show that there is no reason to fear any injury to fish life from normal dressings to land in the vicinity of streams or ponds from any of the following fertilizers: Nitrate of lime, superphosphate of lime, basic slag, muriate of potash, sulphate of potash, kainit, nitrate of soda, and Peruvian guano. In regard to the remaining fertilizers, he says it may be inferred that lime and calcium cyanamide should not be applied to land which immediately drains into a pond or stream of small volume in which there are fish. Sulphate of ammonia undergoes rapid change in the soil; and unless it were wholly extracted by rain falling immediately after its application, there would appear to be little risk attendant on its use, though, as a measure of precaution, it might be well to leave a strip of land, about 10 to 20 yards in width, bordering on the pond or stream, undressed with sulphate of ammonia. It is impossible to speak definitely in regard to stable manure because of the wide variations in it; but it seems undesirable to dress land with stable manure right up to the borders of valuable fishing streams (if they are of small volume). Mr. Butterfield thinks the experiments made on gudgeon justify the conclusions he has drawn being applied in reference to trout and all other fresh-water fish.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

Glasgow.—A Manchester resident passing through the "Second City" has called attention, in the "Glasgow Herald," to the fact that in the city where Smoke Abatement Exhibitions and Lectures have been held, under the auspices of the City Fathers, and the lectures in many cases delivered by some of them, he noticed "great volumes of smoke belching forth from a chimney situated towards the right-hand front portion of the magnificent City Hall. Having only just previously passed the exceedingly spacious gas show-rooms, in which the citizens are urged to use gas-fires to assist in overcoming the smoke nuisance, it seems a paradox to find the City Fathers setting such a noble example in allowing a chimney to get sufficiently foul to emit dense smoke from 2.10 to 2.20 p.m." This is a strong indictment against which the Corporation will have some difficulty in finding a defence. It might be almost too much to expect them to use gas-fires throughout this large building; but surely coke might be used for the general heating, and gas-fires where separate fires are required in private offices, &c. No doubt Mr. Wilson will be only too pleased to arrange for this, and then we shall have an example of a Corporation practising what it preaches. The Town Council, who decided to take in private the question of increases in the salaries of their principal officers, have rejected most of the proposed increases to the higher officials, among others being that proposed for Mr. Alexander Wilson, the General Manager of the Gas Department. Mr. Wilson's salary, considering the very responsible and arduous work devolving upon him in connection with such a large undertaking as the Corporation Gas Department, is a very small one, and the Council should take an early opportunity of reconsidering their decision in this matter.

Aberdeen.—In regard to the water supply question, further details of the report by Messrs. C. P. Hogg, of Glasgow, and Mr. C. H. Roberts, the Engineer at Aberdeen, are to hand. Their report has already been referred to. They found the waters of the River Avon distinctly superior to those of the Rivers Dee and Dye. They now say, further, that "in comparing the three sources, however, it should be remembered that the supplies from the Dee and the Dye would be filtered; while it is not proposed to filter the Avon water. As the benefit to be obtained from filtration is very great, it is doubtful whether

Gas Plant and all constructional Steel and Iron Work.

Specialists in Slot Meters, Ordinary Meters, Wet & Dry.

WILLEY & CO., LTD., ENGINEERS,

EXETER, LONDON, & LEICESTER.

The Pioneers of Slot Installations.

Gas Fires.

Gas Fittings.

Gas Cookers.

PICKERING'S VALVE. LIVESEY WASHERS.

Telegrams: "WILLEY, EXETER." "METERS, LEICESTER."

Telephone Nos.: 132 EXETER. 4777 LEICESTER.

NOTE ADDRESSES.

Head Offices: EXETER.

London Offices: 18, ADAM STREET, ADELPHI, W.C.

SHOW-ROOMS: LONDON, 18, Adam Street, Adelphi, W.C.

an Avon supply unfiltered would show superiority, chemically or bacteriologically, over properly filtered supplies from either of the two sources. In any event, it would be difficult to find many towns enjoying supplies superior to that which could be obtained from any one of the three sources referred to."

Bothwell and Uddingston.—The Gas Company have had a most successful year; and Mr. Lawrence Hislop is to be congratulated upon the results. There is a credit on the revenue account to April 30 of £3101. The Directors have recommended a dividend of 12 per cent. for the year, and carry forward £128 more than was brought over from the previous twelve months.

Falkirk.—The Manager, Mr. W. Wilson, reported to the Gas Committee that the new ammonia scrubber was in action and working very satisfactorily. He submitted tenders for the relining of the coke-hoppers, and that of Messrs. Hamilton and Calder, of Coatbridge, was accepted. The Lighting Committee have had before them the report by the Gas Manager on improved street lighting by gas, and also the report of the Electrical Engineer on electric street lightiug. The best lamps of each kind are to be obtained, and the consumption and illuminating power of each taken by Mr. Ronald, who will report as to the results and costs to the Lighting Committee in June. The Town Council approved of the minutes.

Musselburgh.—The Gas Company have applied to the Town Council for a piece of ground adjoining their works for an extension of their plant; but "amenity" and golf have caused the Council to suggest that, instead of extending their present works, they should remove them to a new site altogether. Thus are the efforts of a Company to improve the supply to a district frustrated by the Local Authority.

Perth.—For the prevention of stoppages through future breakdowns of the stoking machinery, a number of spare parts are to be provided. The difficulty as to the payment for the Bridge of Earn Gas-Works has been settled by a visit of a representative of the Secretary of Scotland, from his office in London; and the transaction was completed upon "term" day. At the meeting of the Gas Committee there was a scene between ex-Bailie Wright, the Convener of the Gas Committee, and ex-Bailie Macpherson. The Convener claimed that the agreement to take over the Bridge of Earn Gas-Works, at the sum they had resolved to give for them, was a wretchedly bad transaction; and the recrimination was of a lively description.

Port Glasgow.—The return of the Burgh finances for the year ending May 15 has turned out highly satisfactory, and it is probable that the rates may be considerably reduced for next year. The surplus from the gas-works undertaking amounts to £1196.

Thornton.—The Town Council have agreed to pay the claim made by the Kirkcaldy District Committee against the County Council for wayleave for the gas-pipe to Thornton, which amounts to £144.

Messrs. George Hands and Co. inform us that Mr. Frederick Turner has resigned his position in their firm, and has commenced business on his own account as a burner and lamp manufacturer.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *May* 24.

Sulphate of Ammonia.

Throughout the week the tone of the market for this material has remained dull, and it has only been found possible to dispose of those parcels offered for sale by making a further concession in prices. The home trade is practically over, and foreign buyers have shown little disposition to operate for near delivery. The closing quotations are £12 18s. 9d. per ton f.o.b. Hull, £13 per ton f.o.b. Liverpool, and £13 1s. 3d. per ton f.o.b. Leith. There has been rather more inquiry from consumers abroad for future shipment, but their ideas and those of producers have still proved too divergent to enable business to be put through, except that which may have been taken for dealers' account.

Nitrate of Soda.

There has been no change in either the tone or the value of this article, and prices are maintained at 11s. 1½d. per cwt. for ordinary quality and 11s. 3d. for refined, on spot.

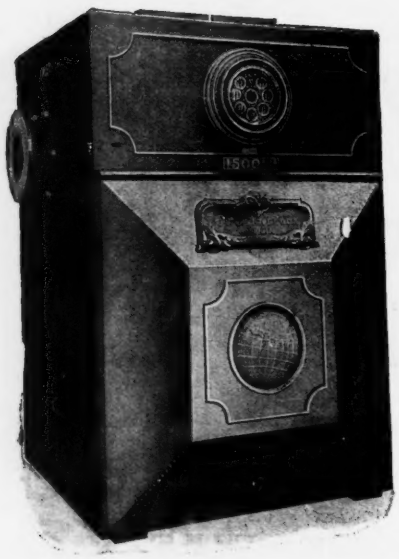
LONDON, *May* 26.

Tar Products.

There is little alteration in the market for tar products; and business is quiet in almost all articles. In regard to pitch, the price remains about the same, and no transactions of importance are notified. Benzols are firm; and the inquiry is good for prompt and forward delivery. Solvent naphthas are quiet; and business has been done at slightly lower prices. Crude carbolic is in a somewhat unsatisfactory state. Consumers will not pay anything like the prices being offered by dealers at the present moment. Creosote is firm in London; but contracts have been accepted at lower prices for Midland and Northern makes.

The average values during the week were: Tar, 27s. to 31s. Pitch, London, 45s. to 45s. 6d.; east coast, 44s. 6d. to 45s.; west coast, Manchester, 43s. 6d. to 44s. 6d.; Liverpool, 44s. 6d. to 45s.; Clyde, 44s. 6d. to 45s. 6d. Benzol, 90 per cent., naked, London, 1s. 0½d. to 1s. 1d.; North, 1s. to 1s. 0½d.; 50-90 per cent., naked, London, 10d. to 10½d.; North, 10d. Toluol, naked, London, 11d. to 11½d.; North, 10¾d. to 11d. Crude naphtha, in bulk, London, 5½d. to 6d.; North, 5d. to 5½d. Solvent naphtha, naked, London, 11½d. to 1s.; North, 10d. to 10½d. f.o.b. Heavy naphtha, naked, London, 11⅛d. to 1s. f.o.b.; North, 10d. to 10½d. f.o.b. Creosote, in bulk, London, 3⅛d. to 3¼d.; North, 2⅝d. to 3d. Heavy oils, in bulk, 3½d. to 3⅝d. Carbolic acid, casks included, 60 per cent., prompt, east and west coasts, 1s. 4d. to 1s. 5d. Naphthalene, £5 to £9; salts, 50s. to 55s., bags included. Anthracene, "A" quality, 1½d. to 1¾d. per unit, packages included and delivered.

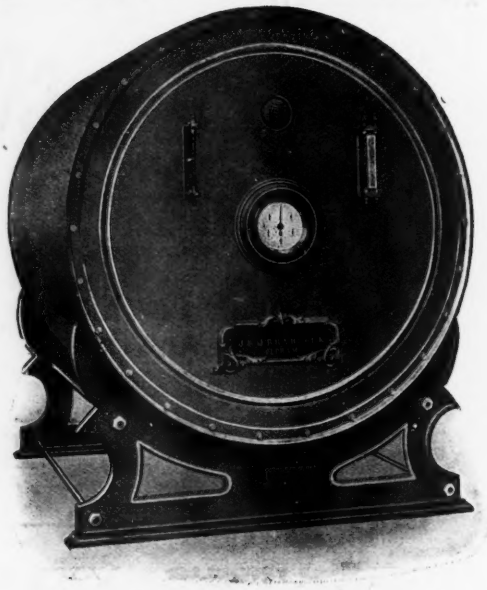
BRADDOCK'S IMPROVED GAS METERS



No. 219. Braddock's Large Dry Meter.

SECOND TO NONE.

Made in all Sizes.



No. 245. Braddock's Large Wet Meter.

J. & J. BRADDOCK (BRANCH OF METERS LIMITED), **Globe Meter Works, OLDHAM,**

Telegrams: "BRADDOCK, OLDHAM." National Telephone No. 815.

AND 45 & 47, WESTMINSTER BRIDGE ROAD, LONDON, S.E.

Telegrams: "METRIQUE, LONDON." Telephone No. 2412 HOP.

Sulphate of Ammonia.

The market continues quiet; and again there has been seen a reduction in the values during the week. Business is reported to have been accepted for the forward position at prices even lower than those quoted to-day. Actual Beckton is quoted as £12 17s. 6d.; outside London makes, £12 10s.; Hull, £12 17s. 6d.; Liverpool, £12 18s. 9d. to £13; Leith, £13 to £13 1s. 3d.; Middlesbrough, £12 18s. 9d.

COAL TRADE REPORTS.

Northern Coal Trade.

There is a quieter tone in the coal trade, though it is more shown in prices than in demand. In the steam coal trade, best Northumbrians are now from 15s. 6d. to 15s. 9d. per ton f.o.b. For second-class steams, about 14s. per ton is the quotation; and for steam smalls, the inquiry is fair at from 10s. 6d. to 11s. 3d. per ton f.o.b. The gas coal trade is brisk for this season of the year—the exports being still heavy. The current prices are from 15s. 2d. to 15s. 6d. per ton f.o.b. for best Durhams, with second kinds from 14s. 9d. to 15s. per ton, and "Wear specials" from near 15s. 9d. per ton f.o.b. It will thus be seen that the easier price that is often known in the summer is now reached. There have been settled the contracts for Caen—some 12,000 tons, at a price expected to leave about 14s. 6d. per ton f.o.b., with the usual allowances for freight, &c. Kjoge is now in the market for some 8000 tons of Durham gas coals, delivered over the second half of this year. There are sales under negotiation of cargoes for Mediterranean ports, at varying prices, but with lower forward tendencies in the values—as high as 27s. being quoted for best Durhams for prompt delivery, and down to 24s. 6d. for seconds. The gas coke market is rather quiet, with prices from 17s. to 17s. 9d. per ton f.o.b.

Scotch Coal Trade.

With the advent of the warmer weather, there has been a slight falling off, and values are not quite so firm as formerly. On the Glasgow Coal Exchange on Friday, the following were the approximate quotations: Steam coal, 13s. 3d. to 13s. 9d.; splint, 14s. 9d. to 15s. 3d.; ell, 13s. 6d. to 14s.; trebles and doubles, 12s. 9d. to 13s. 3d.; and singles, 12s. 6d. to 13s., f.o.b. Glasgow.

We learn that Mr. H. Saville has become associated with the management of the firm of Messrs. F. C. Sugden and Co., gas and carbonizing engineers, of Leeds, in place of the late Mr. F. C. Sugden. Mr. Saville is a member of a well-known gas engineering family (being the son of the late Mr. G. E. Saville, of North Wales and Southport), and has had a lifelong experience in gas-works construction.

Death of a South Metropolitan Ambulance Man.

A distressing incident, of which an exaggerated account appeared in certain London papers, interfered with the competition for the "Good Samaritan" trophy by the ambulance men in the service of the South Metropolitan Gas Company, which was to have taken place last Tuesday—one of the men having unfortunately died suddenly. The following are the facts: The trophy was presented by the late Sir George Livesey in 1903 for competition among teams from each of the Company's stations and such separate departments, as are determined from time to time. All the men competing must hold a "First Aid" certificate of the St. John Ambulance Association. Each team consists of four actual competitors, who provide from among their friends a man to act as patient. Three outside doctors are employed, who, in addition to examining each man in the competition for his general knowledge, set a supposed case of accident. The four members of each team have then to bandage and do whatever may be necessary to their patient. They do this work under the supervision of the doctor in charge, who awards marks as he may see fit. At this year's competition, ten teams entered, and, as usual, they drew for their turn in the competition. The Bankside team was drawn for the fifth place. Until their turn comes, all the competitors and patients have the use of the Institute billiard-rooms, tea-rooms, &c., in which they may pass the time. The unfortunate man who died—a Bankside man named John Hartwell, who was to act as patient for the team—had arrived at the Institute about an hour before, and was sitting in the tea-room having tea, when he had a sharp attack of heart disease. Artificial respiration was tried; but, in spite of all efforts, the man died within a few minutes, notwithstanding the presence of four doctors and about 60 skilled ambulance men. There was no such sensational effect as was described in some of the papers. The man had travelled to East Greenwich, was taking his tea as he might have been doing at home, and had not, when his end came, taken any part in the competition. It may be mentioned that the Company are very strong in ambulance work, having some 800 men who hold "First Aid" certificates, besides 170 uniformed full members of the St. John Ambulance Brigade. These uniformed members are always requisitioned when any public procession is about to take place; and they also do excellent voluntary work on some of the open spaces on Bank Holidays. The officials consider the movement an excellent one, and the Company give it every encouragement.

Congleton Gas Profits.—The receipts of the Congleton gas undertaking for the past financial year were £10,757, compared with £10,012 for the previous twelve months; and the gross profit is £3334, against £3364. Deducting interest, income-tax, depreciation, and redemption of loans, and adding bank interest, there is arrived at a net profit of £1375, which compares with £1309. Satisfaction is felt in the Council with the results achieved.

PARKINSON
WATER HEATERS.

The
"NEW TREASURE" GEYSER

The most satisfactory low-priced Geyser.

No. 92, with Interlocking Gas and Water Taps,
Heats 2½ Gallons per Minute, £3 5s.

LOW PRICE=SMALL HIRE RATE=INCREASED CONSUMPTION.

See Hot Water Catalogue No. 100.

THE PARKINSON STOVE CO., Ltd.
(Incorporating Maughan's Patent Geyser Co.),
BIRMINGHAM and LONDON.

New Issues of Gas and Water Capital.

At the Mart, Tokenhouse Yard, E.C., last Tuesday Messrs. A. & W. Richards placed three new issues of capital under instructions from Directors. The Wandsworth, Wimbledon, and Epsom District Gas Company offered £20,000 of new ordinary stock, ranking for a standard dividend of 3½ per cent., subject to the sliding-scale, equally with the existing Wandsworth "C" stock, which now receives a dividend at the rate of £5 17s. 3d. per cent. per annum, and it was all sold at from £115 to £119 per £100 of stock. Some of the Company's 4 per cent. perpetual debenture stock realized from £94 to £95 per £100. An issue of 1000 new ordinary £10 shares in the Southend Water Company, ranking for a maximum dividend of 5 per cent. equally with the Company's existing similar shares, the dividends on which for the past four years have been at the rate of 4½ per cent. per annum, fetched from £9 to £9 5s. each.

Evesham Gas Undertaking.

Alderman Fisher, in moving the adoption of the minutes of the Gas Committee at the quarterly meeting of the Evesham Town Council, referred to the balance-sheet for the year ended March 31, and said the revenue account showed the total receipts to be £11,095 and the expenditure £9286, leaving a balance of £1808 gross profit. The receipts from gas sold for private use amounted to £6967, against £7059 for the previous year, which showed that increased business had almost been equal to the reduction due to the lower charges per 1000 cubic feet which had operated during the year. Gas used for public lighting amounted to £476, against £548. The sale of gas increased from 44,820,000 to 46,928,000 cubic feet. The balance of the revenue account was disposed of as follows: £589 had been written off capital accounts for depreciation; interest and instalments of loans absorbed £293; and the contribution to the district fund, £600—leaving a balance of £325 to carry to profit and loss account. Considering the high price of coal and other materials, he thought they could congratulate themselves upon another successful year's trading. Alderman New said it was particularly gratifying to see that the decrease in the charge for gas had really improved the business, and that the amount lost in actual revenue was such a small sum. It was obvious that cheaper gas must tend to attract more customers; and it was in the interest of the Council as gas manufacturers to make their product as cheap as possible. They might consider that the Gas Committee were doing good work, and that the report was very satisfactory.

Gas Profits and the Rates at Southport.

The question of the levying of the borough rates for the ensuing year was before the Southport Town Council at a special meeting last Wednesday. The Chairman of the Finance Committee (Mr. T. H. Gregson) said the total debits amounted to £8568, and the credits to £2291; leaving a sum of £6277 as the increased expenditure to be met. The Committee proposed to adjust this by asking the Gas Committee to contribute £14,000 (instead of £13,000) to the relief of the rates, by taking a further £1000 from the exchequer account, and by raising the balance of £4000 by increasing the rates 2d. in the pound. Alderman Trounson moved an amendment to the effect that the borough rate be 1s. 5d. in the pound instead of 1s. 4½d., and that the Gas Committee be asked for £13,000 instead of £14,000. He described it as being an "immoral imposition" to ask for even £13,000 of the Committee's profits for the relief of the rates. Coal this year would cost considerably more, and a decrease of revenue amounting to £3500 would be brought about by reducing the price of gas from 2s. 8d. to 2s. 6d. per 1000 cubic feet. If the Corporation paid its way, it would mean an increase of 3d. in the pound on the rates; and if they went on borrowing and incurring liabilities as they had been doing, it would mean next year a further rate of 3d. in the pound. Parliament now recognized that it was an immoral proceeding for a corporation to compel one portion of the community to relieve the rates of another portion; and this was what was done when the gas profits were used for this purpose. The amendment was seconded by Mr. Richardson, but it was defeated.

Kent Coal in Gas-Works.—At a meeting of the Ramsgate Gas and Water Committee some days ago, it was decided to purchase 1000 tons of coal from the local Snowdown Colliery Company, with the option of taking a further 4000 tons, if required.

Street Lighting at Salford.—There was a tame ending in the Salford Town Council to a proposal by Mr. Greenwood that a Special Committee should be appointed to inquire and report as to whether the public lighting in the borough is efficiently carried out. Mr. Greenwood urged that, besides being inefficient, the lighting of the Salford streets was more costly than in some other towns; and the poorness of the illumination he attributed to the "old-fashioned character of the lamps." During his speech, some members of the Council left the room; and it was pointed out that there was no quorum. Accordingly, the sitting ended. Mr. Alderman Hulton (the Chairman of the Lighting and Cleansing Committee) invited Mr. Greenwood to lay the matter before the Committee, promising that his representations would have full consideration.

Haverhill Gas Undertaking.—Dealing with the working of the Haverhill gas undertaking for the past year, Mr. J. B. Coster pointed out to the members of the Urban District Council that the outstanding feature was the abnormal rise in the price of coal. He thought that, if coal had remained at the same price as the year before, the balance-sheet would have justified them in reducing the price of gas by 2½d. per 1000 cubic feet. The sales of gas had increased about 5 per cent., which was a very healthy sign, showing, as it did, that the demand had not yet reached high-water mark. During the year they had received over £1000 for residuals, which was a record. The profit was £563, against £835 last year; but they had had to do a little more in the way of maintenance of works. The balance-sheet showed that their loans were down to £2280, against £2635 in the previous year. They would practically disappear at the end of 1916.

SAWER & PURVES

(BRANCH OF METERS LTD.)

— POSITIVE —

PREPAYMENT METERS.

MILES PLATTING, RADFORD ROAD,

MANCHESTER & NOTTINGHAM.

Agent for Scotland:

JNO. D. GIBSON, 2, CAUSEYSIDE STREET, PAISLEY.

Vertical Retorts for Bangor (Co. Down).—At an inquiry held by Mr. P. C. Cowan, Chief Engineering Inspector of the Local Government Board for Ireland, into applications by the Bangor District Council for (*inter alia*) sanction to a loan of £11,360 for installing vertical retorts, &c., at the gas-works, the Clerk (Mr. John Milliken) said the borrowing powers of the Council for the gas undertaking were £17,277, of which they had received £15,691. In 1884, the quantity of gas consumed was 1,194,000 cubic feet, but in the past financial year it was 47,744,000 cubic feet; the average increase per annum being 7·4 per cent. The Gas Manager (Mr. Barker Mitchell) and Mr. J. D. Smith, the Gas Engineer and Manager of the Belfast Corporation, gave evidence to the effect that the scheme now proposed was the best possible to meet the requirements of the town.

Defence of the Metropolitan Water Board.—Last Tuesday evening, Mr. E. B. Barnard, the Chairman of the Metropolitan Water Board, delivered a lecture at the Royal Sanitary Institute on the "London Water Supply." He defended the Board's administration, and claimed that they deserved public confidence. Referring to the deficiency, he said it amounted to a net sum of £251,924. But he explained that during their existence they had paid £373,518 into the sinking fund; so that instead of a deficiency, imposed on them only by the method of account-keeping fixed in their Act, the Board really had a surplus of £121,394. If those who caused a loss of £40,000 a year by sinking wells in order to avoid using the Board's water were to continue to evade their public responsibilities in respect of water for safeguarding their premises from fire and cleansing of the streets, some fresh legislation would be necessary. The vast proportion of the Board's expenditure was practically uncontrollable by that body. Of an expense amounting to considerably over £2,000,000 last year, the only part over which they had practical control was £469,000. Where the Board could control expenditure, they had kept it down, and had shown a moderation and prudence which invited every comparison with the past.

Heywood and Middleton Water Board.—The annual report of the undertaking of the Heywood and Middleton Water Board shows a loss of £10,725 on the year's working. Last year's loss was £10,759, and that of the preceding year £10,773. The loss will have to be met by the ratepayers of Middleton and Heywood; and it has been decided to levy precepts on the two Town Councils for the following sums: Heywood, £5429; Middleton, £5295. These losses fall very heavily on the ratepayers of both towns. Heywood in particular will feel the burden, as the rates of the borough have this year been advanced by 10d. in the pound.

The Hingham and District Gas Company, Limited, has been registered with a capital of £1000, in £1 shares.

Nimrod, Limited, is the title of a Company for gas-burner manufacture recently registered with a capital of £2000, in £1 shares. The object of the Company is to acquire from Mr. Campbell Murray Hunter a patent relating to improvements in atmospheric gas-burners, and the business carried on by him in connection therewith.

Among the cases for hearing in the King's Bench Division of the High Court of Justice last Wednesday, before Mr. Justice Rowlatt, was that of *Ransome v. Leibbrand*. The parties to the action were given as Arthur Sidney Ransome, of The Lawns, Southgate, and C. H. Leibbrand, whose address was given as New Southgate. The name of the defendant will doubtless be remembered in connection with his scheme for the making of Harwich dealt with in "Electricity Supply Memoranda" a fortnight ago. The plaintiff's claim was for £120, principal and interest, on defendant's dishonoured acceptance for £120 drawn by plaintiff on July 10, 1911, and payable four months after date. Defendant did not admit the acceptance; and, furthermore, said if he did accept there was no consideration for it. In the result, the Jury returned a verdict for the plaintiff for the sum of £120, with costs.

GAS COMPANIES' STOCK AND SHARE LIST.

The Stock Exchange had a most uninteresting and unsatisfactory time last week. Business was at its lowest ebb, and not a market had the slightest life in it. There was little to tempt the public, or even the professional speculator, into enterprise, for factors were all adverse. Continuous delay and uncertainty in regard to a settlement of Balkan affairs, and apprehension of further labour troubles at home, sufficed to deter almost the hardiest from active adventure. Had it not been for the new Chinese loan, things would have been deadly dull indeed. In result, prices everywhere (except American, which had pretty well reached the bottom already) closed at a fall. On Monday, business was at the quietest owing to the influences above indicated. Lower figures were marked generally. Rails were lower all round, and Americans were depressed; but Government issues were too inactive to move. Business continued extremely limited on Tuesday, and the tone in general was depressed, though American brightened up a bit before the close. The lowering effect of new issues put Consols down ⅛ for money and ¼ for the account. Rails were very dull; and even the Great Northern settlement could not engender a recovery. Americans, however, marked a moderate advance. Wednesday was almost lifeless; nothing being thought of but the Chinese loan. Consols went down another ⅛, and Rails fell for lack of support, but again Americans were the best market. Thursday was just as dull and disheartening, and prices kept on drooping. Consols were ⅛ lower for money; and all departments in general were depressed. Prices continued to fall on Friday; and the best that can be said is that the final figures at the close of the day were rather better than the earlier. Consols again lost ⅛ for money and for the account; and Rails and Foreign were in poor case. Americans amended somewhat. Saturday was almost a *dies non*, but for the loyal demonstration in greeting of Empire Day made by members at the opening for business. There was not enough doing to set any tone; but, so far as indications went, markets were no worse. Consols closed at 74⅝ to 74⅞—a fall of ⅛ in the week. The Money Market was at first quiet, but the tone became much easier later on. Business in the Gas Market was certainly more active than in the preceding week; but it was rather devoid of interesting features, and the tendency seemed scarcely so robust, although there was very little change in quotations. In Gaslight and Coke issues, the ordinary was up to its average activity, and the prices marked ranged from 102½ to 103½. In the secured issues, the maximum was done at 80, and the preference at 94½ to 95. South Metropolitan was moderately dealt in at 110 to 111; and the debenture made 74. In Commercials, the 4 per cent. realized 106. Among the Suburban and Provincial group, Alliance and Dublin changed hands at 70⅜ (a fall of 3), Bournemouth "B" at 16⅛, Brighton original at 207, South Suburban at 117, and (on the local Exchanges) Liverpool "A" at 211, Newcastle at 98½, and Sheffield "C" at 226. In the Continental companies, Imperial was done at 167½ to 169½ (a fall of 1), ditto debenture at 86¼, Union at 82⅜ to 83⅜, and European at 17½ to 17⅞. Among the undertakings of the remoter world, Bombay realized 6 9/16, Cape Town preference 4, Primitiva 6¼ to 6⅜, and ditto preference 4⅛ to 5 1/16.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	April 11	5	Alliance & Dublin Ord.	70–73	−5	6 17 0
374,000	,,	Jan. 16	4	Do. 4 p.c. Deb.	84–87	..	4 12 0
280,000	5	April 11	7⅛	Bombay, Ltd.	6¼–6⅜	..	5 11 1
50,000	10	Feb. 27	15	Bourne- 10 p.c.	28½–29½	..	5 1 8
332,000	10	,,	7	mouth Gas B 7 p.c.	15⅝–16¼	..	4 6 8
75,000	10	,,	6	and Water Pref. 6 p.c.	13⅝–14¼	..	4 4 3
880,000	Stk.	Feb. 27	14	Brentford Consolidated	260–265	..	5 5 8
330,000	,,	,,	11	Do. New	200–205	..	5 7 4
50,000	,,	,,	5	Do. 5 p.c. Pref.	113–115	..	4 6 11
206,250	,,	Dec. 12	4	Do. 4 p.c. Deb.	94–96	..	4 3 4
217,380	Stk.	Feb. 27	11	Brighton & Hove Orig.	206–211	..	5 4 3
244,200	,,	,,	8	Do. A Ord. Stk.	151–154	..	5 3 11
530,000	20	Mar. 28	12½	British	45–46	..	5 8 8
120,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb. Stk.	89–91	..	4 7 11
245,771	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	91½–93½	..	4 5 7
100,000	10	—	—	Cape Town & Dis., Ltd.	2–3	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	4–5	..	—
100,000	Stk.	Dec. 30	4½	Do. 4½ p.c. Deb. Stk.	78–83	..	5 8 5
157,150	Stk.	Feb. 13	5	Chester 5 p.c. Ord.	109½–111½	..	4 9 8
1,513,280	Stk.	Feb. 27	5/9/4	Commercial 4 p.c. Stk.	105–107	..	5 2 1
560,000	,,	,,	5¼	Do. 3½ p.c. do.	102–104	..	5 2 6
475,000	,,	Dec. 12	3	Do. 3 p.c. Deb. Stk.	71–73	..	4 2 2
800,000	Stk.	,,	4	Continental Union, Ltd.	82–85	..	4 14 2
200,000	,,	,,	7	Do. 7 p.c. Pref.	130–132	..	5 6 1
492,270	Stk.	—	5⅜	Derby Con. Stk.	124–125	..	4 12 0
55,000	,,	—	4	Do. Deb. Stk.	103–105	..	3 16 2
1,002,180	10	Jan. 16	10	European, Ltd.	17½–18½	..	5 8 1
16,415,840	Stk.	Feb. 13	4/17/4	Gas- 4 p.c. Ord.	102–104	..	4 13 9
2,600,000	,,	,,	3½	light 3½ p.c. max.	80–83	..	4 4 4
4,062,235	,,	,,	4	and 4 p.c. Con. Pref.	94–97	..	4 2 6
4,674,850	,,	Dec. 12	3	Coke 3 p.c. Con. Deb.	73–75	..	4 0 0
258,740	Stk.	Mar. 13	5	Hastings & St. L. 3½ p.c.	89–91	..	5 9 11
82,500	,,	,,	6½	Do. do. 5 p.c.	—	..	—
70,000	10	April 25	11	Hongkong & China, Ltd.	16½–17*	..	6 9 5
131,000	Stk.	Mar. 13	7⅞	Ilford A and C	154–155	..	4 18 4
65,780	,,	,,	6⅛	Do. B	120–122	..	5 0 5
65,500	,,	Dec. 30	4	Do. 4 p.c. Deb.	89–91	..	4 7 11
4,940,000	Stk.	May 16	9	Imperial Continental	167–170*	−1	5 5 11
1,235,000	Stk.	Feb. 13	3½	Do. 3½ p.c. Deb. Red.	85–87	..	4 0 6
200,342	Stk.	Mar. 13	6	Lea Bridge Ord. 5 p.c.	120–123	..	4 17 7
£			p.c.				£ s. d.
561,000	Stk.	Feb. 27	10	Liverpool United A	210–212	..	4 14 4
718,100	,,	,,	7	Do. B	151–153	+1	4 11 6
306,083	,,	Dec. 20	4	Do. Deb. Stk.	98–100	..	4 0 0
63,480	Stk.	Jan. 16	3	Maidstone 3 p.c. Deb.	68–70	..	4 5 9
75,000	5	Nov. 28	6	Malta & Mediterranean	4¾–5	..	6 0 0
250,000	100	April 1	4½	Met. of Melbourne 4½ p.c. Deb.	98–100	..	4 10 0
541,920	20	Oct. 30	4½	Monte Video, Ltd.	12⅜–13¼	..	5 5 8
1,775,892	Stk.	Feb. 27	4½	Newc'tle&G'tesh'd Con.	98–99	−½	4 10 11
529,705	Stk.	Dec. 30	3½	Do. 3½ p.c. Deb.	85–86	..	4 1 5
55,940	10	Feb. 27	7/7/0	North Middlesex 7 p.c.	13–14	..	5 4 7
300,000	Stk.	May 16	8	Oriental, Ltd.	124–129*		6 4 0
60,000	5	Mar. 28	10	Ottoman, Ltd.	8–8⅜	..	5 17 8
60,000	50	Feb. 27	13	Portsea, Island B	125–128	..	5 1 7
100,000	50	,,	12	Do. C	122–125	..	4 16 0
249,980	5	May 16	8	Primitiva Ord.	6⅛–6⅜*	..	6 0 9
499,960	5	Dec. 30	5	,, 5 p.c. Pref.	4¼–5⅛	..	4 17 7
521,600	100	Dec. 2	4	,, 4 p.c. Deb.	95–97	..	4 1 8
346,198	Stk.	Dec. 30	4	River Plate 4 p.c. Deb.	92–94	..	4 5 1
275,000	5	Apl. 11	12	San Paulo, Ltd.	—	..	—
150,000	10	,,	6	Do. 6 p.c. Pref.	11¼–11⅜	..	5 2 2
125,000	50	Jan. 2	5	Do. 5 p.c. Deb.	49–51	..	4 18 0
135,000	Stk.	Mar. 13	10	Sheffield A	225–227	..	4 8 1
209,984	,,	,,	10	Do. B	225–227	..	4 8 1
523,500	,,	,,	10	Do. C	225–227	..	4 8 1
90,000	10	Sept. 27	7½	South African	10–11	..	6 16 4
6,429,895	Stk.	Feb. 13	5/9/4	South Met., 4 p.c. Ord.	110–112	..	4 17 7
1,895,445	,,	Jan. 16	3	Do. 3 p.c. Deb.	73–75	..	4 0 0
209,820	Stk.	Feb. 27	8½	South Shields Con. Stk.	161–163	..	5 4 4
952,795	Stk.	Feb. 27	6	S'th Suburb'n Ord. 5 p.c.	117–119	..	5 0 10
60,000	,,	,,	5	Do. 5 p.c. Pref.	115–117	..	4 5 6
117,058	,,	Dec. 30	5	Do. 5 p.c. Deb. Stk.	117–119	..	4 4 0
594,740	Stk.	May 16	5	Southampton Ord.	100–103*	..	4 17 1
120,000	Stk.	Feb. 13	7½	Tottenham A 5 p.c.	139–142	..	5 2 1
483,940	,,	,,	5⅝	and B 3½ p.c.	115–117	..	4 18 3
149,470	,,	Dec. 30	4	Edmonton 4 p.c. Deb.	92–94	..	4 5 1
182,380	10	,,	5	Tuscan, Ltd.	5–6	..	8 6 8
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	96½–98½	+½	5 1 6
236,476	Stk.	Feb. 27	5	Tynemouth, 5 p.c. max.	114–115	..	4 6 11
255,636	Stk.	Mar. 13	6⅞	Wands- B 3½ p.c.	137–140	..	4 18 2
88,416	,,	Dec. 30	3	worth 3 p.c. Deb. Stk.	68–70	..	4 5 9

Prices marked * are "Ex-Div." † Next Dividend will be at this rate.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

ENGINEER AND MANAGER. Northwich Gas Company. Applications by June 14.
CHIEF CHEMIST. No. 5742. Applications by June 6.
DRAUGHTSMAN. Newton, Chambers, and Co., Thorncliffe Iron Works.
CHEMICAL PLUMBER. Staveley Coal and Iron Company.
RETORT SETTERS. Firth Blakeley, Sons, and Co., Dewsbury.

Appointments, &c., Wanted.

TRAVELLER. No. 5739.
CHEMICAL PLUMBER. Davies, Galloway Road, Shepherd's Bush, W.
REPRESENTATIVE (LIGHTING GOODS). Haynes, Nottingham.

Plant, &c. (Second Hand), for Sale.

PIPES, &c. Halifax Gas Department. Tenders by June 21.
PURIFIERS, &c. No. 5732.
WASHER, STEAM ENGINE, &c. Peterborough Gas Company.

Plant, &c. (Second-Hand), Wanted.

ENGINE, EXHAUSTER, WASHER, SCRUBBER, PURIFIERS, &c. No. 5735.
GASHOLDER. No. 5741.

Stocks and Shares.

BARNET GAS AND WATER COMPANY. London Mart. June 3.
BOURNEMOUTH GAS AND WATER COMPANY. By Tender. June 5.
EAST GRINSTEAD GAS AND WATER COMPANY. London Mart. June 3.
GRAYS AND TILBURY GAS COMPANY. London Mart, June 17.
HYTHE AND SANDGATE GAS COMPANY. London Mart. June 3.
LOWESTOFT WATER AND GAS COMPANY. London Mart, June 17.
NORTH MIDDLESEX GAS COMPANY. By Tender. June 7.
TENDRING HUNDRED WATER COMPANY. London Mart. June 3.

TENDERS FOR

Coke.

SUTTON IN ASHFIELD GAS DEPARTMENT. Tenders by June 3.

Coal.

ABERAVON GAS DEPARTMENT. Tenders by June 14.
ASHFORD GAS DEPARTMENT. Tenders by June 6.
AUDLEY URBAN DISTRICT COUNCIL. Tenders by June 3.
CHESTER GAS COMPANY. Tenders by June 9.
COCKERMOUTH GAS DEPARTMENT. Tenders by June 9.
DONCASTER GAS DEPARTMENT. Tenders by June 13.
DROITWICH GAS DEPARTMENT. Tenders by June 5.
EAST DEREHAM URBAN DISTRICT COUNCIL. Tenders by June 2.

Coal—*continued.*

ELSECAR, &c., GAS COMPANY. Tenders by June 9.
GLASGOW GAS DEPARTMENT. Tenders by June 3.
LEEK GAS DEPARTMENT. Tenders by June 2.
MANCHESTER GAS DEPARTMENT. Tenders by June 2.
NORTHWICH GAS COMPANY. Tenders by June 12.
OXFORD GAS COMPANY. Tenders by June 16.
PETERBOROUGH GAS COMPANY. Tenders by June 7.
SALISBURY GAS COMPANY. Tenders by June 9.
SEDGLEY URBAN DISTRICT COUNCIL. Tenders by June 6.
TIPTON GAS DEPARTMENT. Tenders by June 3.

General Stores (Lime).

WALSALL GAS DEPARTMENT. Tenders by June 3.

Oil for Gas-Making.

MANCHESTER GAS DEPARTMENT. Tenders by June 5.

Oxide.

ROCHDALE GAS DEPARTMENT. Tenders by June 4.

Retort-Settings (Inclined).

MIDDLETON GAS DEPARTMENT. Tenders by June 11.

Tar and Liquor.

DENTON GAS DEPARTMENT. Tenders by June 4.
DONCASTER GAS DEPARTMENT. Tenders by June 13.
EASTBOURNE GAS COMPANY. Tenders by June 5.
HUDDERSFIELD GAS DEPARTMENT. Tenders by May 31
LEEK GAS DEPARTMENT. Tenders by June 2.
READING GAS COMPANY. Tenders by June 16.
SUTTON-IN-ASHFIELD GAS DEPARTMENT. Tenders by June 3.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

United Kingdom: One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.
Payable in advance. If credit is taken, the charge is 25s. a year.
Abroad (in the Postal Union): £1 7s. 6d., payable in advance.

All Communications, Remittances, &c., to be addressed to
WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.
Telegrams: "GASKING FLEET, LONDON." Telephone: P.O. 1571a Central.

OXIDE OF IRON.

O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 171, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

D. ANDERSON AND COMPANY,
GAS LIGHTING ENGINEERS AND CONTRACTORS.
18 & 20, FARRINGDON ROAD, LONDON, E.C.
Telegrams: "DACOLIGHT LONDON." Telephone: 2336 HOLBORN.

BRISTOL'S RECORDING GAUGES.

THE MOST EXTENSIVE RANGE OF RECORDING INSTRUMENTS IN THE WORLD.

40 LISTS DESCRIBE THESE INSTRUMENTS.

J. W. & C. J. PHILLIPS, LTD.,
23, COLLEGE HILL, CANNON STREET, LONDON, E.C.
Recording Pressure Gauges.
Recording Vacuum Gauges.
Combination Recording Pressure and Vacuum Gauges.
Recording Draught Gauges.
Recording Hydraulic Pressure Gauges.
Recording Water Level Gauges.
Recording Thermometers.
Indicating Thermometers.
Indicating and Recording Electric Pyrometers for Water Gas Plants.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, London, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 815 Oldham, and 2412 Hop, London.
Telegrams—
"BRADDOCK, OLDHAM," and "METRIQUE, LONDON."

BENZOL
AND
CARBURINE FOR GAS ENRICHING.
ALSO
THE MAXIM PATENT CARBURETTOR.

For Prices, &c., apply to
THE GAS LIGHTING IMPROVEMENT CO., LTD.
SALISBURY HOUSE, LONDON WALL, E.C.
Telephones: 4452 and 4453 London Wall.
Telegraphic Address: "Carburine, London."

SULPHURIC ACID.

SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.
SPENCER CHAPMAN & MESSEL, LTD.,
with which is amalgamated WM. PEARCE & SONS, LTD.
36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
Telegrams: "HYDROCHLORIC, FEN. LONDON."
Telephone: 1588 AVENUE (3 lines).

POULTONS & TIMMIS, Ltd.

CARBONIZING and Boiler Setting Engineers, Complete Installations undertaken.
Their Retort Settings are THE best.
GUARANTEED RESULTS.
Registered Office: READING. Telephone: 265 Reading.
London Office: HALTON HOUSE, 20/23, HOLBORN.
Telephone: 2619 Holborn.
Manchester Office: 55, CROSS STREET.

OXIDE OF IRON.
SPENT OXIDE PURCHASED.
BALE'S FIRE CEMENT.
PAINT FOR GAS-WORKS.
"KLEENOFF," THE COOKER CLEANER.
BALE & CHURCH, LTD.
5, CROOKED LANE, LONDON, E.C.

TAR WANTED.
THOMAS HORROCKS & SONS, LTD.,
Albert Chemical Works,
GRANT STREET, MILES PLATTING, MANCHESTER.
Pitch, Creosote, Brick and Fuel Oils, Benzol, Solvent Naphtha, Carbolic, Sulphate of Ammonia.

SULPHURIC ACID.

SPECIALLY prepared for Sulphate of AMMONIA Makers by
CHANCE AND HUNT, LIMITED.
Works: OLDBURY, WEDNESBURY, AND STAFFORD.
Address Correspondence and Inquiries to OLDBURY, WORCS.
Telegrams: "CHEMICALS, OLDBURY."

R. & G. HISLOP,
GAS ENGINEERS, RETORT BUILDERS, CONTRACTORS, &c.

RETORT SETTINGS, COAL TESTING PLANT, BOILER FIRING.

Communications should be addressed to
UNDERWOOD HOUSE, PAISLEY.

KINDLY NOTE!!!
GEYSERS AND CIRCULATORS
ARE SPECIALITIES AT
BLENHEIM WORKS, HAMMERSMITH.
Telegrams: "Gasoso London." Telephone: 14 Hammersmith.